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Pricing of Deposit Insurance

Luc Laeven

The World Bank
Financial Sector Strategy and Policy Department
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Abstract

Laeven aims to provide guidelines for the pricing of deposit insurance in different countries. He presents several methodologies that can be used to set benchmarks for the pricing level of deposit insurance in a country, and quantifies how specific design features affect the cost of deposit insurance.

The author makes several contributions to our understanding of what drives the price of deposit insurance. For example, he shows how risk diversification and risk differentiation within a deposit insurance system can reduce the price of deposit insurance. Laeven also finds that deposit insurance is underpriced in many countries around the world, notably in several developing countries. More important, his estimates suggest that many countries cannot afford deposit insurance.

Deposit insurance is unlikely to be a viable option in a country with weak banks and institutions. The author does not recommend a funded deposit insurance scheme, but rather he argues that for countries that have adopted or are adopting deposit insurance and have decided to pre-fund it, pricing it as accurately as possible is important.

This paper—a product of the Financial Sector Strategy and Policy Department—is part of a larger effort in the department to study the costs and benefits of deposit insurance. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Rose Vo, room MC9-624, telephone 202-473-3722, fax 202-522-2031, email address hvo1@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at llaeven@worldbank.org. July 2002. (69 pages)

Pricing of Deposit Insurance

Luc Laeven[1]

[1] The World Bank, Llaeven@worldbank.org, Tel. 202-4582939. The author would like to thank Thorsten Beck, Jerry Caprio, Asli Demirgüç-Kunt, Oliver Fratzscher, Tom Glaessner, Jim Hanson, Patrick Honohan, Yongbeom Kim, Daniela Klingebiel, Giovanni Majnoni, Soledad Martinez Peria, Larry Promisel, Olga Sclovscaia, and seminar participants at the World Bank for helpful discussions and comments, and Ying Lin for research assistance.

Pricing of Deposit Insurance

Introduction

Recently, many countries have implemented deposit insurance schemes and many more countries are planning to do so. The design of this part of the financial safety net differs across countries, especially in account coverage. Countries that introduce explicit deposit insurance make many decisions: which classes of deposits to insure and up to what amount, which banks should participate, who should manage and own the deposit insurance fund, and at what levels premiums should be set. When countries elect not to introduce explicit deposit insurance, insurance is implicit. In either case, the benefits banks gain depend on how effective the government is at managing bank risk-shifting.

Explicit deposit insurance schemes appeal increasingly to policymakers. First, an explicit scheme supposedly sets the rules of the game regarding coverage, participants, and funding. Second, an explicit scheme is appealing to politicians because it protects small depositors without immediate impact on the government budget. One should, however, not ignore the potential cost of deposit insurance. Deposit insurance reduces the incentives for (large) depositors to exert market discipline on banks, and encourages banks to take on risk. This form of moral hazard has received a lot of attention in the deposit insurance literature.[2]

In this paper, we investigate how different design features of deposit insurance schemes affect the price of deposit insurance. The goals of the paper are twofold: (i) to present several methodologies that can be used to set benchmarks for the pricing level of deposit insurance in a country; and (ii) to quantify how specific design features affect the price of deposit insurance.

Throughout the paper we refer to the funding of deposit insurance as the actual contributions by banks to cover deposits and to the pricing of deposit insurance as the actuarially fair price of deposit insurance. Actual contributions can be made on an ex-ante

[2] Bhattacharya and Thakor (1993) model the incentives by which deposit insurance invites insured banks to seek excessive portfolio risk and keep lower liquid reserves relative to the social optimum. An overview of the economics of deposit insurance is provided by Bhattacharya, Boot, and Thakor (1998).

basis, in which case contributions are typically accumulated towards a deposit insurance fund or reserve, or on an ex-post basis, in which case banks pay deposit insurance premiums or levies only after bank failures occur. Actual contributions by banks can differ substantially from estimates of the actuarially fair price of deposit insurance for several reasons. First, deposit insurance can be over- or underpriced. Second, the estimate of the fair price of deposit insurance may be biased. Third, the government may contribute funds or issue guarantees on certain bank liabilities. And fourth, actual contributions are not always smoothed over time, unlike fair premiums that are typically calculated as annual annuities. For instance, many countries establish target fund levels. Once the fund achieves its target level, contributions may be (close to) zero. Also, countries may decide to set contributions high initially in order to quickly reach a certain minimum fund size.

The academic foundations for measuring the value of deposit insurance lie in Merton (1977), who models deposit insurance as a put option on the value of the bank's assets. Most of the empirical literature on deposit insurance has either focused on the issue of over- or underpricing of deposit insurance or on how different design features affect the effectiveness of deposit insurance. No study thus far has systematically investigated how the different design features affect the value of deposit insurance, and therefore its pricing.

In countries with explicit deposit insurance, deposit insurance is underpriced (overpriced) if the deposit insurer actually charges less (more) for its services than the estimated opportunity-cost value of these services. Underpricing of deposit insurance services is a sign that banks extract deposit-insurance subsidies. Marcus and Shaked (1984) use Merton's (1977) theoretical model of deposit insurance to estimate the actuarially "fair" value of deposit insurance. By comparing these implicit premiums with the official insurance premiums for US banks they test empirically whether deposit insurance is over- or underpriced.[3]

[3] Duan and Yu (1994) find that Taiwanese deposit-taking institutions were heavily subsidized by the deposit insurance fund of Taiwan during the period 1985 to 1992. Fries, Mason and Perraudin (1993) find that Japanese institutions were heavily subsidized by the deposit insurer during the period 1975 to 1992. Hovakimian and Kane (2000) find that US banks shifted risk onto the safety net during the period 1985 to 1994, despite regulatory efforts to use capital requirements to control risk-shifting. Kaplan (2002) finds that Thai banks received implicit deposit insurance subsidies from the government during the years prior to the

The effectiveness of deposit insurance has been shown to be country-specific. Demirgüç-Kunt and Huizinga (1999) offer empirical evidence that explicit deposit insurance introduces a trade-off between the benefits of increased depositor safety and the costs of reduced creditor discipline. Demirgüç-Kunt and Detragiache (1999) find cross-country evidence that explicit deposit insurance increases the probability of banking crises in countries with weak institutional environments. Cull, Senbet and Sorge (2000) argue that the introduction of an explicit deposit insurance scheme should be accompanied by a sound regulatory scheme to deter instability and encourage financial development. Kane (2000) argues that the design of a country's financial safety net should take country-specific factors into account, in particular differences in informational environments and the enforceability of private contracts. Demirgüç-Kunt and Kane (2002) argue that explicit deposit insurance should not be adopted in countries with a weak institutional environment. This literature also argues against pre-funding deposit insurance in a weak institutional environment, as the evidence suggests that losses will be high in this case. In countries with weak institutions, these funds can literally be looted. The present paper does not challenge this view, but rather argues that for countries that have adopted or are adopting deposit insurance and have decided to pre-fund it, pricing it as accurately as possible is important. Consistent with this literature, we find that many countries cannot afford fairly priced deposit insured.

Laeven (2002b) investigates how country-specific and bank-specific features contribute to the opportunity-cost value of deposit insurance services, with a special focus on the comparison of the opportunity-cost value of deposit insurance services in countries with explicit deposit insurance and countries without explicit deposit insurance. Laeven (2002b) finds that the opportunity-cost value of deposit insurance services is higher in countries with explicit deposit insurance. The detrimental impact of explicit deposit insurance is largely offset in countries with high-quality and well-enforced legal systems, and the value of deposit insurance is found to be higher for banks with concentrated ownership. Hovakimian, Kane and Laeven (2002) investigate the

financial crisis in 1997. Laeven (2002a) interprets the estimate of the opportunity-cost value of deposit insurance services as a proxy for bank risk and shows that this proxy has predictive power in forecasting bank distress. He also finds that this measure of bank risk is higher for banks with concentrated ownership and high credit growth, and for small banks.

effectiveness of private and governmental controls on bank risk-shifting incentives across a large sample of countries. Their results show that significant portions of the variation in the effectiveness of risk control are explained by differences in contracting environments. On balance, explicit deposit insurance expands risk-shifting opportunities in poor contracting environments, but this effect is reduced in systems that impose appropriate combinations of loss-sharing rules, risk-sensitive premiums, and coverage limits. They also find that recent adopters of explicit insurance have done a particularly poor job of replacing the private discipline that explicit insurance displaced.

The paper proceeds as follows. Section 1 describes several methods to price the value of deposit insurance. Section 2 presents several examples and case-studies on how different design features of deposit insurance affect its pricing structure. Section 3 investigates whether deposit insurance is underpriced around the world. Section 4 summarizes our findings, translates some of our findings in good practices for deposit insurance, and concludes.

1. Deposit Insurance Pricing Methods

Several methods exist to price deposit insurance. Central to any deposit insurance pricing method is a methodology to estimate the risk of the value of a bank's assets. To estimate bank risk and set deposit insurance premiums, regulators typically use (a combination of) qualitative indicators collected from on-site and off-site bank examinations, together with accounting-based indicators, such as CAMEL-type indicators.

In the academic literature, several methods have been developed that make use of market-based indicators. Most of these methods are based on Merton (1977)'s option-pricing model that models deposit insurance as a put option on the bank's assets. This model is attractive from an academic point of view, because it is based on a theoretical framework that establishes a direct link between the value of the deposit insurance contract and the value of the bank's assets, and because it uses the market's assessment of the value of the bank's equity and assets rather than accounting values. The basic model in Merton (1977) has been extended by several authors to include different design features of the deposit insurance contract and to deal with several practical estimation problems when implementing the model. We will discuss each of these models in the following section.

Another approach of pricing deposit insurance is known as "expected loss pricing". This approach is centered around the expected default probability of a bank, which can be estimated using fundamental analysis and/or market analysis. Fundamental analysis is typically based on CAMEL-type ratings, and thus on accounting values. Market analysis is typically based on interest rates or yields of uninsured bank debt, such as certificates of deposits (CDs), inter-bank deposits, subordinated debt, and/or debentures.

If markets are efficient, market prices reflect their true value, meaning that all relevant and ascertainable information is reflected in asset prices.[4] Therefore, in countries with well-developed capital markets, market-based models are to be preferred over accounting-based models of deposit insurance. However, the application of market-based models of deposit insurance is limited. First, market-based models may give poor estimates of asset risk in countries with underdeveloped (illiquid) capital markets. Second, market-based information is not available for all banks. For example, market value of equity are only available for listed banks, and debenture yields are available only for banks that have issued debentures. For these reasons, practical models of pricing deposit insurance typically embed both market-based and accounting-based information.

In the next sections, we introduce the Merton (1977) option-pricing model of deposit insurance (and several of its implementations and extensions) and the expected loss pricing approach to pricing deposit insurance.

1.1 Merton (1977)'s Limited-Term Put-Option Model of Deposit Insurance

In this section we describe Merton's (1977) model of deposit insurance that can be used to calculate the implicit value of deposit insurance, and the implementations of the model by Ronn and Verma (1986) [henceforth, RV (1986)]. Merton (1977) shows that the payoff of a perfectly credible third-party guarantee on the payment to the bondholders of a firm where there is no uncertainty about the obligation of the guarantee being met is

[4] A pre-condition for efficient markets is that information is widely and cheaply available.

identical to that of a put option, where the promised payment corresponds to the exercise price, and the value of the firm's assets V corresponds to the underlying asset.

In applying this model to a bank, corporate debt corresponds to deposits. Because most deposits are due on demand, the maturity of deposit debt is very short. Customarily, the maturity of the option is conceived as the time until the next audit of the bank's assets. Two more assumptions are conventionally made. First, it is assumed that deposits equal total bank debt and that principal and interest are both insured. Second, the bank's asset value is assumed to exhibit geometric Brownian motion

$$d \ln V_t = \mu dt + \sigma dW_t \tag{1}$$

where V is the value of assets, μ is the instantaneous expected return on assets, σ is instantaneous expected standard deviation of assets returns, and W indicates a standard Wiener process. This allows us to use the Black and Scholes (1973) option-pricing model to value the deposit insurance per unit of deposits

$$g = \Phi(\sigma\sqrt{T-t} - h_t) - \frac{(1-\delta)V_t}{D}\Phi(-h_t), \tag{2}$$

where $h_t = \dfrac{\ln\left(\dfrac{(1-\delta)V_t}{D}\right) + \dfrac{\sigma^2}{2}(T-t)}{\sigma\sqrt{T-t}}$, g is the value of the deposit insurance guarantee per dollar of insured deposits, Φ is the cumulative normal distribution function, T is the time until maturity of the bank debt, t is time, D is the face value of the bank debt, and δ is the annualized dividend yield.

To apply the model, values have to be assigned to two unobservable variables: the bank's asset value V and the volatility parameter σ. RV (1986) generate proxy values for these unknowns from two identifying restrictions. The first restriction comes from modeling the directly observable equity value of the bank as a call option on the bank's assets with a strike price equal to the value of bank debt

$$E_t = V_t\Phi(d_t) - D\Phi(d_t - \sigma\sqrt{T-t}) \tag{3}$$

where $d_t = \dfrac{\ln\left(\dfrac{V_t}{D}\right) + \dfrac{\sigma^2}{2}(T-t)}{\sigma\sqrt{T-t}}$. RV (1986) model equity as being dividend protected and therefore dividends do not appear in the equation (3). Note that if dividends are zero, that $h_t = d_t$.

The relationship between the equity and asset volatility implied by the call valuation becomes the second restriction

$$\sigma = \frac{\sigma_E E_t}{V_t \Phi(d_t)}, \tag{4}$$

where σ_E is the standard deviation of equity returns.[5] Since the market value of equity is observable and the equity volatility can be estimated, two non-linear restrictions are now in place for identifying two unknowns.

Data on total debt, bank equity, and equity volatility allow equations (3) and (4) to be solved simultaneously for the value of the bank's assets, V, and the volatility of asset returns, σ. From these two values, the value of deposit insurance per unit of deposits can be calculated using equation (2).[6] The RV (1986) method uses the sample standard deviation of daily stock returns as an estimator for instantaneous equity volatility. Duan (1994) points out that this is not an efficient estimator for instantaneous equity volatility. When using the RV (1986) method, it is therefore recommended to use high-frequency data to improve the efficiency of the estimator.

Thus far, we have assumed that the next audit of the bank will take place in one year, and that the debt matures at the audit date. We have thus modeled deposit insurance as a limited-term contract. Since it is likely that the government will give the bank some forbearance after it finds out that the bank is undercapitalized modeling deposit insurance as a one-year contract is restrictive. It is clear that the value of insurance is higher if the audit indicates that a bank is undercapitalized and the government gives the bank forbearance instead of forcing it to immediately increase its capital ratio.

[5] When estimating annual equity volatility from a sample of daily equity returns, it is recommended to follow Fama (1965) who suggests to ignore days when the exchange is closed.

[6] When comparing premiums across countries, the value of deposit insurance per unit of deposits has to be normalized on a single currency unit by the using the same currency for each country.

RV (1986) incorporate capital forbearance by the bank regulators by permitting asset values to deteriorate to a certain share of debt value, $\rho < 1$, before the option kicks in. More specifically, RV (1986) assume a closure rule of $V \leq \rho D$, where V is the value of the bank's assets, D is the value of the bank's debt, and ρ is the regulatory forbearance parameter. In essence, the RV (1986) specification transfers (1- ρ) times the bank's expected debt repayment as risk capital to stockholders, irrespective of the bank's financial status.[7] With the $V \leq \rho D$ closure rule, the modified model is

$$E_t = V_t \Phi(d_t') - \rho D \Phi(d_t' - \sigma\sqrt{T-t}) \tag{5}$$

where $d_t' = \dfrac{\ln\left(\dfrac{V_t}{\rho D}\right) + \dfrac{\sigma^2}{2}(T-t)}{\sigma\sqrt{T-t}}$, and

$$\sigma = \frac{\sigma_E E_t}{V_t \Phi(d_t')}. \tag{6}$$

RV (1986) estimate instantaneous equity volatility by the sample standard deviation of daily equity returns and therefore impose equity volatility to be constant. Duan (1994, 2000) points out that such a premise is inconsistent with the underlying theoretical model of Merton (1977) where equity volatility is stochastic. Therefore, the RV (1986) estimator does not possess the properties such as consistency and efficiency normally expected from a sound statistical procedure. Duan (1994, 2000) has developed a maximum likelihood framework to estimate the value of the deposit insurance which is consistent with the assumption of Merton's (1977) theoretical model that equity volatility is stochastic. The Duan (1994, 2000) method has been applied to a large sample of banks by Laeven (2002a).

As an alternative to risk-based deposit insurance premiums, Kuester King and O'Brien (1991) consider a risk-adjusted examination schedule whereby riskier banks are examined more frequently with the possibility of closure or regulatory action following each examination. They show how Merton's (1977) framework can be used to derive such a risk-adjusted examination schedule. In essence, rather than setting different prices for deposit insurance, this approach sets different examination frequencies.

[7] Hovakimian and Kane (2000) suggest assigning forbearance benefits only to economically insolvent banks.

For several reasons, Merton's (1977) option-pricing model of deposit insurance gives downward biased estimates of the benefits bank stockholders derive from the safety net. First, the basic model in Merton (1977) ignores the possibility of regulatory forbearance. RV (1986) incorporate capital forbearance by the bank regulators by permitting asset values to deteriorate to a given percentage of debt value before the option kicks in. However, the level of regulatory control is unknown ex ante which makes it difficult to incorporate the RV (1986) model. Moreover, as Laeven (2000b) points out, the level of forbearance is likely to vary across countries. It is likely that regulatory control is weaker in countries with weak banks, so that one would underestimate the value of deposit insurance to the most risky banks.

Second, by imposing prompt option settlement, Merton's (1977) single-period model of a limited-term option contract understates stockholder benefits from deposit insurance more than multi-period models do. The counterfactual assumption of a limited-term option contract is that at the time of an audit the bank's insurance premium is adjusted to a new actuarially fair rate, as in a variable rate insurance scheme, and/or that the bank's capital ratio is adjusted back to its minimum required level. Merton (1978) extends the standard single-period model of deposit insurance to a multi-period setting by treating deposit insurance as an infinite-maturity put option. In Merton's model, the government randomly audits banks and closes banks if the bank becomes economically insolvent. We describe Merton's (1978) model in more detail in the next section. Pennacchi (1987a, 1987b) allows for unlimited term contracts and shows that the assumption of a limited-term contract in a single-period model can underestimate the value of deposit insurance.

Third, Kane (1995) argues that option-pricing models suffer from treating banking risk as exogenous, from presuming the possibility of accurate risk measurement and ex ante pricing, and from modeling deposit insurance as a bilateral contract between the insurer and the bank, thereby ignoring the agency conflicts that arise from the difficulty of enforcing capitalization requirements in a multilateral nexus of contracts. In reality, there is no market for options in open-ended commitments if banking risk cannot be observed and controlled on a continuous basis, even in well-developed capital markets.

RV (1986) emphasize that the option-based approach lends itself more readily to cross-sectional comparisons of risks across banks rather than assessing under- or overpricing of deposit insurance. They find that the rank orderings of banks remain robust to changes in model specifications, such as periodicity of audit and degree of forbearance.

1.1.a Application of the Merton (1977) model

Next, we illustrate how deposit insurance premiums vary by input parameters in the theoretical model of Merton (1977). For simplicity we assume that dividends are zero, and that the time until the next audit (the maturity of the put option) equals one. In that case, it follows from equation (2) that the theoretical deposit insurance premium per unit of deposits (at time zero) depends only on the asset volatility, σ, and the financial leverage, *D*/*V*, of the bank. Panel A in Table 1 presents the deposit insurance premium per US dollar of deposits (in percentage points). For example, for a bank with asset volatility of 4 percent per annum and a value of bank assets equal to 105 percent of the value of bank debt, the deposit insurance premium equals 0.22 percent of total bank deposits. We find that as leverage increases, or as *V*/*D* decreases, that the per deposit premium of deposit insurance tends to increase. We also find that greater asset volatility increases the per deposit premium of deposit insurance.

To assess more precisely the sensitivity of the estimate of actuarially fair premiums to changes in financial leverage or asset volatility it can be useful to calculate the Delta, Δ, and the Vega of the deposit insurance put option contract. The Delta represents the rate of change of the deposit insurance premium with respect to the value of bank assets, and the Vega is the rate of change in the price of deposit insurance with respect to the volatility of bank assets. Assuming dividends are zero, a the time until maturity is one year (*T*=1), and keeping the value of deposits constant, Delta is given by

$$\Delta = \frac{\partial g}{\partial V} = \Phi(\tilde{h}_t) - 1 \tag{7}$$

and Vega is given by

$$Vega = \frac{\partial g}{\partial V} = V\Phi'(\tilde{h}_t) = \frac{V \exp(-\tilde{h}_t^2 / 2)}{\sqrt{2\pi}} \tag{8}$$

where $\tilde{h}_t = \dfrac{\ln\left(\dfrac{V_t}{D}\right) + \dfrac{\sigma^2}{2}}{\sigma}$.

Table 1 Deposit insurance premiums in the Merton (1977) model

Premiums are expressed in percentage points of deposits. Dividends are assumed zero. Time until the next audit (T) equals one. Time indicator (t) equals zero.

V/D \ σ	1%	2%	3%	4%	5%	10%	15%	20%	25%
0.90	10.00	10.00	10.00	10.00	10.03	10.71	12.02	13.59	15.27
0.95	5.00	5.00	5.05	5.18	5.39	6.89	8.67	10.52	12.40
1.00	0.40	0.80	1.20	1.60	1.99	3.99	5.98	7.97	9.95
1.05	0.00	0.00	0.07	0.22	0.45	2.06	3.95	5.91	7.89
1.10	0.00	0.00	0.00	0.01	0.06	0.95	2.50	4.29	6.19
1.15	0.00	0.00	0.00	0.00	0.00	0.39	1.52	3.06	4.81
1.20	0.00	0.00	0.00	0.00	0.00	0.15	0.89	2.15	3.71

1.1.b Application of the Ronn and Verma (1986) model

The Merton (1977) model cannot be applied in practice, because its two parameters, the value of bank assets and asset volatility, are not observed. This section illustrates how deposit insurance premiums vary by input parameters when applying RV's (1986) practical implementation of Merton's (1977) model. We assume that dividends are zero, that the time until maturity equals one year, and that all bank debt is insured. In this case, it follows from equations (2) to (4a) that the price of deposit insurance can be expressed as a function of two observable variables: the equity volatility, σ_E, and the ratio of the market value of equity to the market value of bank debt, *E*/*D*.

Panel A in Table 2 presents the RV (1986) deposit insurance premiums as a percentage of deposits assuming that there is no regulatory capital forbearance. Panel B follows the specification in RV (1986) model and assumes that there is capital forbearance of the degree $\rho = 0.97$, meaning that the bank is closed if the value of the bank's assets is less than or equal to 97 percent of the value of the bank's debt. RV (1986) takes this level as a reasonable proxy for the level of regulatory forbearance in the US. Although this level of forbearance seems reasonable in a number of other countries, the level of forbearance is likely to be higher in many other countries, such as most developing countries, where enforcement of regulation tends to be weak. Panel C assumes a larger degree of capital forbearance by setting the forbearance parameter ρ to 0.95. The range of premiums in Panel C thus seems to be more applicable to most developing countries.

We find that the price of deposit insurance increase with the level of equity volatility. The relation between deposit insurance premiums and the inverse leverage ratio E/D is less straightforward, and depends on the assumed degree of regulatory forbearance, ρ. The reason is that the deposit insurance premiums are expressed as a percentage of deposits. The price of deposit insurance is also highly affected by the level of regulatory forbearance. In particular, going from $\rho=1$ to $\rho=0.97$ has large impact on the premium. Indeed, RV (1986) show for a sample of US banks that the rank ordering of premiums is less robust to changes in ρ than to changes in other model specifications. The reason is that a change in ρ has an impact on both the leverage and the estimate of asset volatility.

In the basic model of RV (1986), the time to maturity, *T*, is assumed to be one year. Merton (1977) interprets the maturity of the put option as the length of time until the next audit. RV (1986) experiment with the maturity by taking values from ¼ to 5 years. They find that increasing the maturity increases the deposit insurance premium, but that the ranking of the banks is not much affected.

Table 2 Ronn and Verma (1986) deposit insurance premiums as % of deposits

Dividends are assumed zero. Time to maturity (T) equals 1. It is assumed that all bank debt is insured.

Panel A: ρ=1 (no capital-forbearance)

E/D \ σ_E	10	20	30	40	50	60	70	80	90	100
1	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.09	0.16	0.29
2	0.00	0.00	0.00	0.00	0.01	0.03	0.08	0.17	0.32	0.55
3	0.00	0.00	0.00	0.00	0.01	0.05	0.12	0.25	0.46	0.80
4	0.00	0.00	0.00	0.00	0.02	0.06	0.15	0.32	0.60	1.03
5	0.00	0.00	0.00	0.00	0.02	0.07	0.17	0.37	0.66	1.24
10	0.00	0.00	0.00	0.01	0.04	0.13	0.30	0.65	1.22	2.06
20	0.00	0.00	0.00	0.01	0.05	0.19	0.47	1.01	1.89	3.13
30	0.00	0.00	0.00	0.01	0.06	0.22	0.56	1.20	2.22	3.68
40	0.00	0.00	0.00	0.01	0.06	0.23	0.61	1.31	2.43	4.05
50	0.00	0.00	0.00	0.01	0.05	0.22	0.61	1.34	2.50	4.18

Panel B: ρ=0.97 (capital-forbearance)

E/D \ σ_E	10	20	30	40	50	60	70	80	90	100
1	2.00	2.00	2.00	2.00	2.01	2.02	2.04	2.09	2.19	2.32
2	1.00	1.00	1.01	1.04	1.10	1.19	1.31	1.49	1.74	2.09
3	0.12	0.24	0.36	0.48	0.62	0.79	0.99	1.27	1.64	2.12
4	0.00	0.04	0.13	0.26	0.41	0.61	0.86	1.19	1.64	2.24
5	0.00	0.01	0.06	0.17	0.31	0.52	0.80	1.17	1.69	2.39
10	0.00	0.00	0.01	0.06	0.18	0.39	0.74	1.27	2.03	3.08
20	0.00	0.00	0.00	0.03	0.13	0.37	0.80	1.50	2.53	3.99
30	0.00	0.00	0.00	0.02	0.11	0.36	0.83	1.62	2.79	4.45
40	0.00	0.00	0.00	0.01	0.10	0.34	0.83	1.65	2.90	4.66
50	0.00	0.00	0.00	0.01	0.09	0.32	0.81	1.65	2.92	4.72

Panel C: ρ=0.95 (capital-forbearance)

E/D \ σ_E	10	20	30	40	50	60	70	80	90	100
1	4.00	4.00	4.00	4.00	4.00	4.02	4.04	4.09	4.17	4.29
2	3.00	3.00	3.00	3.00	3.01	3.04	3.10	3.21	3.41	3.71
3	2.00	2.00	2.00	2.03	2.09	2.19	2.36	2.61	2.97	3.46
4	1.00	1.04	1.14	1.27	1.43	1.64	1.91	2.27	2.76	3.40
5	0.20	0.40	0.60	0.80	1.03	1.30	1.64	2.09	2.66	3.44
10	0.00	0.00	0.05	0.19	0.42	0.75	1.21	1.85	2.71	3.88
20	0.00	0.00	0.01	0.06	0.23	0.56	1.09	1.90	3.05	4.62
30	0.00	0.00	0.00	0.04	0.18	0.49	1.06	1.94	3.22	4.98
40	0.00	0.00	0.00	0.03	0.14	0.45	1.01	1.93	3.27	5.12
50	0.00	0.00	0.00	0.02	0.12	0.40	0.96	1.88	3.25	5.14

1.2 Merton (1978)'s Unlimited-Term Put-Option Model of Deposit Insurance

Merton (1978) models deposit insurance as an infinite-maturity put. The model extends the limited-term model in Merton (1977) to an unlimited term model and takes into account explicitly surveillance or auditing costs and provides for random auditing. Several papers have built on this multiperiod perspective by incorporating a variety of features describing bank and regulator behavior, such as endogenous capital adjustments and regulatory forbearance.[8]

We present Merton's (1978) model without dividend payments. The government randomly audits banks and follows the no-forbearance closure rule $V \le D$. Let λ be the audit rate (in other words, λdt is the probability of an audit taking place over the next instant), K the audit costs, and, as before, let V equal the value of the bank's assets, D the value of the bank's deposits, and σ the volatility of the bank's asset returns.

Merton (1978) shows that, if there are no barriers to entry into banking, that the equilibrium deposit insurance premium per dollar of deposits can be written as

$$p_1^*(x) = 1 - \frac{k^* - 1}{\delta^* + k^*} x^{-\delta^*}, \quad x \ge 1 \tag{9}$$

where $x = V/D$, $k^* = \frac{1}{2}\{1 - \delta^* + [(1+\delta^*)^2 + \gamma]^{1/2}\}$, $\delta^* = 2\lambda K/\sigma^2$, and $\gamma \equiv 8\lambda/\sigma^2$.

1.2.a Application of the Merton (1978) model

Next, we investigate how changes in the input parameters affect the deposit insurance premiums predicted by the Merton (1978) model. As in Saunders and Wilson (1995), we set audit costs per dollar of deposits, K, to 0.000134 (the US historical equivalent) and the auditing frequency, λ, is set equal to 1. The resulting premium values, $p_1^*(x)$, are treated as lump-sum perpetuities and multiplied by a yield rate to derive an equivalent annual payment amount. As yield rate we use either 4 percent (panel A in Table 3) or 8 percent

[8] Pennacchi (1987a) extends the model to endogenize mispriced deposit insurance. Allen and Saunders (1993) model deposit insurance as a callable put, i.e. a compound option consisting of an infinite-maturity put option held by the banks and a valuable call provision regarding timing of bank closure retained by the deposit insurer. Cooperstein, Pennacchi, and Redburn (1995) separate the cost of deposit insurance on a period-by-period basis, generalizing the Merton model that only gives an estimate of the current present value of deposit insurance. Saunders and Wilson (1995) incorporate interim dividend payments by allowing shareholders to receive dividends until the next audit occurs, even if the bank becomes insolvent in the interim.

(panel B in Table 3). The premiums are highly affected by the yield rate on Treasury bills. Basically, a doubling in the yield rate doubles the premium.

Unlike the premium in the Merton (1977) model, $p_1^*(x)$ is not a monotonically decreasing function of the assets-to-deposits ratio, *V/D*. The reason is that there are two sources of the deposit insurer liability in the Merton (1978) model: (a) the guarantee of deposits which is a monotonically decreasing function of the assets-to-deposits ratio, as in the Merton (1977) model, and (b) the surveillance or audit cost which is a monotonically increasing function of the assets-to-deposits ratio. The latter increases even though the cost per audit is assumed constant because the expected number of audits prior to a "successful" audit where the bank is found to be insolvent is an increasing function of the assets-to-deposits ratio. In particular, we find that leverage does not affect the premium in case the asset return volatility is high.

Table 3 Deposit insurance premiums in the Merton (1978) model

Deposit insurance premiums are expressed in percentage points of deposits. Premiums are calculated under the assumption that dividends equal zero. λ is set equal to one. *K*=0.000134, and the Treasury yield (discount factor) equals 4 percent per annum. Premiums are calculated only for $V/D \geq 1$.

V/D \ σ	1%	2%	3%	4%	5%	10%	15%	20%	25%
1.00	0.10	0.09	0.11	0.13	0.15	0.28	0.41	0.53	0.65
1.05	0.58	0.22	0.16	0.16	0.17	0.28	0.41	0.53	0.65
1.10	0.98	0.34	0.22	0.19	0.19	0.29	0.41	0.53	0.65
1.15	1.32	0.44	0.27	0.22	0.21	0.29	0.41	0.53	0.65
1.20	1.61	0.54	0.31	0.25	0.23	0.30	0.41	0.53	0.65

1.3 Expected loss pricing

The option-pricing methodology in Merton (1977, 1978) is limited to application to banks for which market valuations of the bank's net worth are available. In practical terms, this typically means that the put option approach to value deposit insurance is limited to application to banks that are listed on a stock exchange. However, Cooperstein, Pennacchi, and Redburn (1995) illustrate how a bank's net worth can be estimated from reported cash flows so that deposit insurance valuation can in principle be applied to all banks, and not just to those that are publicly traded.

Nevertheless, one should acknowledge the limitations of the option-pricing methodology, in particular when applied to banks in countries that are not market-oriented. In this section we introduce an alternative methodology to pricing deposit insurance known as expected loss pricing. The advantage of this methodology is that is very general in setup and can therefore be adopted to fit country-circumstances.

The principle of expected loss pricing is simple, and can be represented by the following equation:

Expected loss = Expected default probability * Exposure * Loss given default.

In the above equation, the "Expected loss" equals the size of the loss to the deposit insurer as a percentage of insured deposits, and thus measures the cost of deposit insurance. In order to breakeven in expectation, the deposit insurer should set a premium per insured deposit equal to the expected loss price. The "Expected default probability" can be estimated using fundamental analysis, market analysis, or rating analysis. Fundamental analysis typically involves the use of CAMEL-like ratings. Market analysis, on the other hand, uses interest rates or yields on uninsured bank debt, such as interbank deposits, subordinated debt, and debentures. Rating analysis indicates the use of credit ratings of rating agencies, such as Moody's and Standard and Poor's. In principle, credit ratings can be based on both fundamental and market analysis, although they also tend to be affected by political considerations. The "Exposure" is usually equal to the amount of insured deposits, but can be set equal to total deposits (uninsured plus insured deposits) in "too big too fail" cases. "Loss given default" indicates the size of the loss to the deposit insurance fund as a percentage of the total defaulted exposure to all insured deposits, and thus indicates the severity of the loss. Good indicators for the loss given default may include the business mix of bank, its loan concentration, and the structure of bank liabilities. Estimates of losses given default are typically also based on historical experience.

Although all three components to the expected loss pricing formula (expected default probability, exposure, loss given default) are equally important in terms of estimating the expected of loss of a bank to the deposit insurance fund, the focus is typically on estimating the default probability of the bank, given that the other two components (exposure and loss given default) are relatively easy to measure given the availability of bank-specific information on the amount of uninsured deposits and historical information on the losses incurred by the deposit insurance fund given default.

In the following section we present how analysis of credit ratings and interest rates on uninsured debt can be used to estimate the expected default probabilities. We focus on the analysis of credit ratings and interest rates rather than on fundamental analysis, because fundamental analysis is more ad hoc and is not based on market principles. Nevertheless, in practice one may use fundamental analysis of expected default probabilities, either as a complement to the other two types of analyses to check for robustness, or in case the other types of analyses cannot be carried out due to the lack of data on either market rates or credit ratings.

Credit ratings can be translated in expected default probabilities by using historical default probabilities. Both rating agencies like Moody's and Standard and Poor's have extensive time series on historical default rates for each of their rating categories. In the case of Moody's, these time series go back to the year 1920. For example, one can translate credit ratings on long-term bank deposits by using historical default rates on corporate bonds in the same rating category, and use these default rates as an estimate of the expected default probability of the bank. To reduce measurement error, it is advisable to estimate one-year default probabilities by taking the average cumulative default rate over several years. The optimal number of years depends on the specific situation. It should be large enough to reduce measurement error, but short enough in order not to use outdated information.

Market analysis of expected default probabilities is based on the principles of no arbitrage and risk-neutral pricing. Let r^f be the interest rate on riskless debt, r the interest rate on risky debt, and p the expected default probability. The principles of no arbitrage and risk-neutral pricing then imply that the payoff of one US dollar invested in riskless debt should equal the expected payoff of one US dollar invested in risky debt. In other words, $1+r^f$ equals $(1-p)(1+r)$. This implies that the expected default probability can be calculated as

$$p = 1 - \frac{1+r^f}{1+r} = \frac{r-r^f}{1+r}, \quad r \geq r^f. \tag{10}$$

In case of deposits, one can apply this methodology to estimate bank default probabilities by setting r equal to the interest rate on uninsured deposits, and r^f equal to the yield on zero-coupon Treasury securities rate. Uninsured deposits can include such deposits as interbank deposits. $r - r^f$ is the risk premium on uninsured deposits.[9]

The above methodology to estimate bank default probabilities is only suitable for application to deposit premiums on uninsured deposits, not to deposit premiums on insured deposits. The reason is that risk premiums on insured deposits not only reflect the risk of the individual deposit-issuing bank (as do risk premiums on uninsured deposits), but are also affected by the credibility of deposit insurance, i.e., the guarantor risk, which is difficult to estimate. Guarantor risk comprises both the risk of repudiation of the guarantee and the restitution costs borne by depositor when seeking restitution of his insured deposit losses. Because of the protection provided by deposit insurance, risk premiums on insured deposits tend to be lower than risk premiums on uninsured deposits. If deposit insurance were fully credible, depositors do not bear losses in case of bank failure, inducing a low risk premium on insured deposits. With imperfect credibility of deposit insurance, the risk premium on insured deposits is higher. By using data on uninsured deposits one avoids the problem of estimating the guarantor risk.

Since the above methodology to estimate bank default probabilities requires the availability of data on deposit rates on uninsured deposits, it can not be applied to countries that insure all deposits. A more general problem with using deposit premiums to estimate default probabilities is that they are influenced by monetary policy and may therefore not only reflect default probabilities.

Given the problems associated with the use of deposit rates to estimate default probabilities, one may consider to use interest rates or yield data on marketable securities

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[9] The existence of a deposit rate premium has been documented in the banking literature. For example, using data on insured certificates of deposit (CDs) rates of US banks, Hannan and Hanweck (1988) find statistically significant relationships between CD rates and institution risk as measured by such variables as leverage, variability of earnings, and risk assets. Using data on CD rates of US thrifts, Cook and Spellman (1994) provide evidence that there is risk pricing of guaranteed deposits, implying expected loss from incomplete deposit insurance coverage. Cook and Spellman (1996) develop a framework that enables to decompose observed CD premiums into firm and guarantor risk. They show that the premiums on guaranteed deposits are multiplicatively related to bank risk and guarantor risk. When bank risk is constant, the premiums as well as interest rate spreads are proportional to guarantor risk. Bartholdy, Boyle, and Stover (2002) find that the deposit premium is higher on average in countries without explicit deposit insurance than in countries with explicit deposit insurance.

to estimate default probabilities, assuming that such data are available. In case of unsecured, risky debt, such as subordinated debentures, we can restate equation (10) as

$$p = 1 - \frac{1 + r^f}{1 + y} = \frac{y - r^f}{1 + y}, \qquad (10a)$$

where p is the one-year probability of default on the default risky debt, y is the yield on the one-year, zero-coupon default risky debt (for example, subordinated debenture), r^f is the yield on the one-year, zero-coupon, default risk-free debt (for example, Treasury bond), and $y - r^f$ is the yield spread. In case of simple, unsecured, subordinated debt with no call features, provisions or restrictions and no liquidity premiums, the yield spread equals the between the one-year zero-coupon yield on the subordinated debenture and the one-year zero-coupon yield on the Treasury security.

In case of zero-coupon default risky debt with a maturity longer than one year, expected default probabilities for each year can be calculated if prices on zero-coupon subordinated debentures and zero-coupon Treasury bonds are available for every year until maturity (see, for example, Iben and Litterman, 1991). In this manner, a term structure of the bank's credit risk can be estimated.

The above analysis can only be applied to risky zero-coupon bonds, not to risky coupon bonds. The reason for this is that, if the bank defaults on a coupon payment, then all subsequent coupon payments (and payments of principal) are also defaulted on. Thus, the default on one of the "mini" bonds associated with a given maturity is not independent of the event of default on the "mini" bond associated with a later maturity. In practice, single payment, zero-coupon corporate bonds may not be traded, in which case it is more difficult to estimate the term structure of spreads. In such cases, and for more complex corporate debt instruments option pricing theory can be applied to price the risky debt and estimate default probabilities (Merton, 1974).

The usefulness of using market rates on unsecured bank debt as a tool for estimating default probabilities not only relies on the liquidity of the unsecured debt market, but it also presumes that holders of such unsecured bank debt exercise market discipline, meaning that they monitor the bank and price the risk of the bank. The banking literature has provided ample evidence of the existence of market discipline in several markets.[10] Of course, the existence of market discipline may differ across countries and debt markets. This should be taken into account when applying the expected loss pricing methodology to price deposit insurance.

1.3.a Application of expected loss pricing

In this section we apply the methodology of expected loss pricing of deposit insurance to bank credit ratings and yields on subordinated bank debt. Table 4 shows the results for different scenarios. Panel A in Table 4 highlights the expected loss pricing method using Moody's credit ratings. Panel B in Table 4 highlights the expect loss pricing method using yield rates on subordinated debt. In principle, one can apply the methodology to any type of uninsured bank debenture, not just subordinated debt.

Column 1 in panel A of Table 4 reports the broad classification of Moody's credit ratings. Moody's credit ratings range from Aaa to C, where Aaa indicates high credit rating and C indicates low credit rating. Column 1 in Panel B reports the yield on a one-year, zero-coupon Treasury bond. We set this yield equal to 3 percent for each scenario. Column 2 in Panel A transforms the credit ratings into five-year average cumulative default rates. The average cumulative default rate over five years are calculated using historical default rates for the period 1920-99 and are taken from Exhibit 31 of Moody's Historical Default Rates of Corporate Bond Issuers, 1920-1999 (Moody's, 2000). Note that we use historical default rates on corporates rather than banks as estimate for the default rates of banks. Column 2 in Panel B reports the spread of a one-year, zero-coupon subordinated bank debt over the one-year, zero-coupon Treasury bond. Column 3 in Panel A reports the one-year default rate for each corresponding credit rating. The one-year default rate is calculated by dividing the average cumulative default rate over five years reported in column 1 by five. Column 3 in Panel B reports the average one-year likelihood of default, which is calculated using risk-neutral pricing (see equation 10a). This means that the average one-year likelihood of default p equals $(y-r^f)/(1+y)$, where $y-r^f$ is the spread of the one-year, zero-coupon subordinated bank debt over the

[10] For example, Martinez Peria and Schmukler (2001) find that depositors in Argentina, Chile and Mexico discipline banks by withdrawing deposits and by requiring higher interest rates on deposits. Flannery and Sorescu (1996) find evidence of bank market discipline in the US subordinated debt market.

one-year, zero-coupon Treasury bond and y is the yield on the one-year, zero-coupon subordinated bank debt, which in this case can be calculated as the yield on a one-year, zero-coupon Treasury bond r^f plus the spread of the one-year, zero-coupon subordinated bank debt $y - r^f$. Column 4 in panels A and B reports the loss rate on assets. The loss rate is set equal to 8 percent of bank assets, which corresponds to the FDIC's historical loss rates on bank assets for banks with assets exceeding 5 billion US dollars. Column 5 in panels A and B reports the expected one-year loss rate as a percentage of assets, which corresponds to the product of the one-year default rate and the loss rate on assets. Column 6 in panels A and B reports the share of deposits in total bank assets, and therefore indicates the loss exposure in terms of total assets. Column 7 in panels A and B reports the expected loss as a percentage of deposits, which corresponds to the quotient of the figures in column 4 and column 5. Column 8 in panels A and B reports the expected loss in basis points (bp) of deposits, and equals the product of 10,000 times the figure in column 6. The expected loss in basis points (bp) of deposits is an estimate of the assessment rate for deposit insurance.

Table 4 Expected loss pricing

Panel A in Table 4 highlights the expected loss pricing method using Moody's credit ratings. Panel B in Table 4 highlights the expect loss pricing method using yield rates on subordinated debt. We set the yield on a one-year, zero-coupon Treasury bond equal to 3% for each scenario. The average cumulative default rate over five years are calculated using historical default rates for the period 1920-99 and are taken from Exhibit 31 of Moody's Historical Default Rates of Corporate Bond Issuers, 1920-1999 (Moody's, 2000). The loss rate is set equal to 8% of bank assets, which corresponds to the FDIC's historical loss rates on bank assets for banks with assets exceeding US$ 5 billion.

Panel A Credit ratings

(1) Credit rating	(2) 5-year cumulative default rate	(3) 1-year default rate	(4) Loss rate on assets	(5) 1-year loss rate (% of assets)	(6) Deposits/ Assets	(7) Expected loss (% of deposits)	(8) Expected loss (bp of deposits)
Aaa	0.20%	0.04%	8%	0.00%	75%	0.00%	0.43
Aa	0.36%	0.07%	8%	0.01%	75%	0.01%	0.78
A	0.55%	0.11%	8%	0.01%	75%	0.01%	1.18
Baa	1.97%	0.39%	8%	0.03%	75%	0.04%	4.21
Ba	12.88%	2.58%	8%	0.21%	75%	0.27%	27.47
B	30.16%	6.03%	8%	0.48%	75%	0.64%	64.33
Caa-C	43.37%	8.67%	8%	0.69%	75%	0.93%	92.52

Panel B Subordinated bank debt

(1) T-bond yield	(2) Spread of subordinated debt over T-bond	(3) 1-year default rate	(4) Loss rate on assets	(5) 1-year loss rate (% of assets)	(6) Deposits/ Assets	(7) Expected loss (% of deposits)	(8) Expected loss (bp of deposits)
3%	0.05%	0.05%	8%	0.00%	75%	0.01%	0.54
3%	0.10%	0.10%	8%	0.01%	75%	0.01%	1.03
3%	0.20%	0.19%	8%	0.02%	75%	0.02%	2.07
3%	0.40%	0.39%	8%	0.03%	75%	0.04%	4.13
3%	0.60%	0.58%	8%	0.05%	75%	0.06%	6.18
3%	0.80%	0.77%	8%	0.06%	75%	0.08%	8.22
3%	1.00%	0.96%	8%	0.08%	75%	0.10%	10.26
3%	1.20%	1.15%	8%	0.09%	75%	0.12%	12.28
3%	1.40%	1.34%	8%	0.11%	75%	0.14%	14.30
3%	1.60%	1.53%	8%	0.12%	75%	0.16%	16.32
3%	1.80%	1.72%	8%	0.14%	75%	0.18%	18.32
3%	2.00%	1.90%	8%	0.15%	75%	0.20%	20.32
3%	2.50%	2.37%	8%	0.19%	75%	0.25%	25.28
3%	3.00%	2.83%	8%	0.23%	75%	0.30%	30.19

2. Design Features and Pricing of Deposit Insurance

Deposit insurance premiums differ widely across countries, depending on the design features of the deposit insurance scheme of the respective countries and their institutional environment, among others. Table 5 presents country averages of actuarially fair deposit insurance premium estimates. These figures are taken from Hovakimian, Kane, and Laeven (2002), and are calculated by applying the RV (1986) method to a large sample of banks in different countries for the period 1991-99. The premiums are expressed as a percentage of deposits, and are estimated either under the assumption of no regulatory forbearance (ρ=1), or under the assumption of a regulatory forbearance parameter of ρ=0.97, as in the original RV (1986) model. The estimates are based on calculations for listed banks and as such for a better-than-average sample of the banks in each country.

Without forbearance the country averages range from less than 0.001 percent of deposits in Australia, Austria, Germany, and Luxembourg to 1.93 percent of deposits in Russia, and average 0.18 percent of deposits. The premiums tend to be lower for developed countries. They average 0.04 percent for developed countries, but 0.32 percent for developing countries. These figures are under-estimates of the actuarially fair price of deposit insurance, mainly because they ignore regulatory forbearance.

With a regulatory forbearance parameter of ρ=0.97, the country-averages range from 0.01 percent of deposits in Australia, Switzerland and the US to 2.94 percent of deposits in Russia, and average 0.41 percent of deposits. The premiums under forbearance also tend to be lower for developed countries. They average 0.15 percent for developed countries, but 0.64 percent for developing countries. It is, however, difficult to choose the level of regulatory forbearance a priori, particularly across countries.

This section investigates how several design features affect the price of deposit insurance, and vice versa. In particular, we focus on the relation between deposit insurance coverage and the price of deposit insurance, and how risk diversification and risk differentiation within a deposit insurance system can reduce the price of deposit insurance.

Table 5 Ronn and Verma (1986) deposit insurance premiums by country

Premiums are expressed as a percentage of deposits. Sample period is 1991-99. Premiums are estimated both under the assumption of no regulatory forbearance (ρ=1.00) and under the assumption of a regulatory forbearance parameter of ρ=0.97 (as in RV, 1986). Time to maturity (T) equals 1. It is assumed that all bank debt is insured. The implied premium estimates are taken from Hovakimian, Kane, and Laeven (2002). The developing versus developed country classification follows the country classification of the World Bank.

Developing countries			Developed countries		
Country	Premium (% of deposits)		Country	Premium (% of deposits)	
	ρ=1.00	ρ=0.97		ρ=1.00	ρ=0.97
Argentina	0.361	0.579	Australia	0.000	0.005
Bangladesh	0.067	0.769	Austria	0.000	0.374
Brazil	0.923	1.701	Canada	0.013	0.143
Chile	0.003	0.018	Denmark	0.091	0.178
Colombia	0.039	0.107	Finland	0.010	0.109
Cyprus	0.043	0.097	France	0.004	0.105
Czech Rep.	0.057	0.323	Germany	0.000	0.152
Ecuador	0.062	0.176	Greece	0.183	0.408
Hungary	0.078	0.422	Hong Kong	0.441	0.614
India	0.192	0.603	Ireland	0.002	0.018
Indonesia	0.466	0.798	Israel	0.001	0.093
Kenya	0.708	1.018	Italy	0.016	0.135
Korea, Rep. of	0.280	0.853	Japan	0.090	0.417
Malaysia	0.350	0.618	Luxembourg	0.000	0.066
Morocco	0.002	0.042	Netherlands	0.003	0.030
Pakistan	0.078	0.403	Norway	0.002	0.174
Peru	0.350	0.670	Portugal	0.005	0.058
Philippines	0.408	0.623	Singapore	0.013	0.040
Poland	0.155	0.276	Spain	0.051	0.073
Russia	1.928	2.943	Sweden	0.021	0.214
South Africa	0.054	0.211	Switzerland	0.002	0.006
Sri Lanka	0.112	0.358	United Kingdom	0.011	0.092
Taiwan	0.020	0.059	United States	0.002	0.009
Thailand	0.780	1.189			
Zimbabwe	0.536	1.157			
Average Developing countries	0.322	0.641	Average Developed countries	0.042	0.153
Grand average	0.188	0.407	Grand average	0.188	0.407

2.1 Design features of deposit insurance

The actuarially fair price of deposit insurance is affected by several structure and design features of a deposit insurance system. The Annex to this paper summarizes some of the most important design features for all existing explicit deposit insurance schemes in the world as of end-year 2000, in particular regarding such issues as membership, administration, funding, coverage, and pricing. [11, 12] For a comprehensive discussion of these design features of deposit insurance systems, we refer to Garcia (2000), Demirgüç-Kunt and Sobaci (2001), World Bank (2001), and Demirgüç-Kunt and Kane (2002).

Bank membership of the deposit insurance system can be compulsory or voluntarily. To reduce adverse selection, membership should be compulsory. Panel A in the Annex shows that most countries indeed opt for compulsory membership (around 86 percent of countries). The effectiveness of regulatory discipline of banks depends to a large extent on how deposit insurance is administered (Barth, Caprio, and Levine, 2001). A deposit insurance scheme may be privately, publicly, or jointly funded and operated, and may or may not have government financial backing. Most countries operate a scheme that has some degree of private funding. Of all countries with a funded scheme, 17.1 percent operate a privately-funded scheme, only 1.4 percent a publicly-funded scheme, and 82.9 percent operate a scheme that is funded jointly by banks and the government. The management of deposit insurance scheme on the other hand tends to remain a public affair. Of all countries with a deposit insurance scheme, only 18.3 percent operate a privately-managed scheme, 50.7 percent a publicly-managed, and 31.0 percent a scheme that is managed jointly by private parties and the government (see panel A in the Annex).

To encourage depositor discipline, some countries require depositors to bear risk on their deposits by adopting a system of coinsurance. Proper coinsurance covers the smallest tranche of deposits in full, and imposes a haircut on larger deposits. This fosters market discipline by the larger depositors, who are expected to have better access to the necessary information to exercise market discipline than small depositors. In practice, coinsurance generally provides that insured depositors are not protected in full, but only

[11] Since end-2000, the introduction of deposit insurance has been planned or is under consideration in the following countries: Albania, Bolivia, China, Costa Rica, Hong Kong, Kuwait, Russia, and Zambia.

[12] Panel A of the Annex presents information regarding membership, administration and funding of deposit insurance by country; panel B presents information regarding the coverage of the scheme; and panel C presents information regarding the pricing of deposit insurance.

for a portion (for example, 90 percent) of their insured balances. As of end-2000, coinsurance was effective in 28.2 percent of countries with explicit deposit insurance, with the depositor standing to loose a small percentage of the covered deposit, while being reimbursed for the majority part (see Panel B in the Annex).

Limiting the coverage of deposit insurance is the most common way to contain moral hazard, and therefore to reduce the price of deposit insurance. Limits render deposit insurance partial. The coverage limit should be low enough to encourage large depositors and creditors to monitor the banks and exercise market discipline. Limits on the insurance coverage expose some depositors to the risk of loss in the event of bank failure and provide incentives for demanding higher deposit rates from weaker banks or for withholding funds entirely from troubled banks. Market discipline can also be achieved by excluding certain types of deposits or bank liabilities, for instance, inter-bank deposits.

Currently, almost all countries place limits on the explicit coverage they offer (see Panel B in the Annex).[13] Several countries have temporarily extended full coverage because of acute financial distress.[14] The coverage varies widely, ranging from 0.2 times per capita GDP in the Ukraine to 19.4 times per capita GDP in Chad. As of end-2000, the average coverage is 3.2 times per capita GDP.[15]

A country has to decide on the types of deposits should be covered, and on the coverage limit for each of the insured type of deposits. Common candidates for exclusion of insurance are inter-bank deposits, government deposits and foreign-currency deposits. Exclusion of such types of deposits can substantially lower the cost of deposit insurance. Most countries aim to insure small household deposits. The percentage of the number of deposits accounts covered therefore tends to be high (on average over 90 percent). However, the percentage of the value of deposits covered can be substantially lower (see panel B in the Annex).

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[13] In some countries, coverage is bank-specific. For example, in Germany coverage varies with a bank's capital.

[14] As of end-2000, six countries (Ecuador, Honduras, Japan, Korea, Mexico, and Turkey) that normally have explicit but limited coverage, have temporarily, but explicitly, extended full coverage. In addition, three countries without a system of deposit insurance (Indonesia, Malaysia, and Thailand) have explicitly extended full coverage during their financial crises.

[15] This figure excludes countries with full coverage.

Another effective way of reducing the coverage of deposits is to exclude large deposits. The advantage of this approach is that it serves the political objective of insuring small household deposits, while encouraging market discipline by large depositors, who are likely to be better informed than small depositors.

The decision whether to cover foreign-currency deposits depends to a large extent on the share of foreign-currency deposits in the country. When usage of foreign currency by households is high, it would be of little value to the households not to cover foreign-currency deposits.[16] The coverage of foreign-currency deposits will, however, discourage the development of local-currency savings. In countries where this is an issue, it may therefore be desirable to have more favorable insurance terms on local-currency deposits than on foreign-currency deposits.

Of all design features, the pricing of deposit insurance is of course most directly reflected in the premium system. As deposits are the entity that is insured, most systems use deposits as the base on which to levy premiums. In some cases, the premiums are levied only on insured categories of deposits or only on the amount actually covered. A few countries use a premium assessment base other than deposits, such as risk-adjusted assets (see Panel C in the Annex).

The premium can be the same for each bank, a so-called flat-rate premium system, or the premium can be differentiated by bank on the basis of bank-specific risks, a so-called risk-based system. The particular difficulties related to executing an equitable system of risk-adjusted premiums include: (a) measuring bank risk; (b) access to reliable and timely data; (c) ensuring that rating criteria are transparent; and (d) examining the potential destabilizing effect of imposing high premiums on troubled banks (Financial Stability Forum, 2001). The most commonly used measures of bank risk include capital adequacy, CAMEL ratings, and supervisory ratings. Some countries combine these measures to arrive at a composite measure for differentiating among banks. Thus far, only a few countries use more complex methods for assessing risk (such as Argentina and

[16] Usage of foreign-currency deposits is high indeed in several countries. As of end-1999, countries with foreign-currency deposits being more than halve of total deposits included: Angola, Argentina, Armenia, Azerbaijan, Bolivia, Bulgaria, Cambodia, Croatia, Georgia, Lebanon, Nicaragua, Peru, and Tajikistan; and countries with foreign-currency deposits being between one-third and halve of total deposits included: Belarus, Costa Rica, Lithuania, Moldova, Mongolia, Mozambique, Philippines, Romania, Russia, Turkey, Ukraine, Vietnam and Zambia (Honohan and Shi, 2002).

Canada). Currently, none of the countries uses the option-pricing method or other market-based methods explored in this paper to assess premiums (see Panel C in the Annex for the basis of risk-adjusting premiums in different countries). Despite the difficulties associated with implementing a risk-based deposit insurance system, an increasingly large number of countries has decided to do so. As of end-2000, risk-adjusted premiums are used in 40.8 percent of countries with explicit deposit insurance.

Before the adoption of a deposit insurance scheme, its insurability should be assessed. The terms and conditions that need to hold for a risk to be insurable can be broadly summarized as fortuity of event, insurable interest of insured parties and indemnity basis of settlement. A more rigorous development of the limits of insurability of risks is given by Berliner (1982). He argues that the insurability of a risk is greater if: (a) losses occur with a high degree of randomness; (b) the maximum possible loss is very limited; (c) the average loss amount upon loss occurrence is small; (d) losses occur frequently; (e) the insurance premium is high; (f) the possibility of moral hazard is low; (g) the coverage of the risk is consistent with public policy; and (h) the law permits the cover. With respect to deposit insurance, arguably only the latter two criteria are met. Bank failures are to some extent predictable and often do not occur independently. For example, during banking crises, many banks enter distress. Thus, deposit insurance losses do not occur with a high degree of randomness. Once losses occur, these losses tend to be large. The failure of a single large bank could in fact pose a systemic risk to the banking sector and have negative spillover effects to the corporate and household sectors. In addition, deposit insurance premiums tend to be set low for political reasons, and deposit insurance encourages extensive moral hazard. These insurability criteria should be taken into account at an early stage when considering the adoption of deposit insurance. If most of these criteria cannot be met at least partially, deposit insurance should not be adopted. Several of these criteria, in particular points (e) and (f) may be largely met through a well-designed deposit insurance scheme. We have presented several methods that can help set premiums that are actuarially fair, and have argued that moral hazard can be curbed by risk-adjusted premiums, a low coverage and co-insurance.[17]

[17] When setting initial contributions in countries where the deposit insurer also has regulatory functions, it should be decided who pays for such regulatory expenses (Buser, Chen and Kane, 1981).

Although we have identified several design features of deposit insurance that could curtail moral hazard, the practical design and implementation of a deposit insurance system needs to deal with several more complicated issues. The challenge is to implement a deposit insurance scheme that is incentive-compatible for all parties involved.[18] An incentive-compatible insurance system would provide incentives to banks to truthfully reveal the necessary information and thereby facilitate the efficient pricing of the risk shifted to the deposit insurer. As mentioned earlier, many countries are considering the introduction of risk-based insurance premiums in an effort to price deposit insurance more fairly and to give better incentives to banks. Although fair pricing of deposit insurance may eliminate inequitable wealth transfers, it need not lead to an efficient equilibrium that is incentive-compatible. For example, when banks have private information concerning the quality of the bank's assets, a risk-sensitive pricing policy is likely to provide banks with similar risk-taking incentives that is associated with a risk-insensitive pricing arrangement.

2.2 Coverage and pricing of deposit insurance

The cost of a deposit insurance system can be dramatically reduced by excluding certain types of deposits (such as large deposits, foreign currency deposits, inter-bank deposits, and/or government deposits). It is therefore often thought that the exclusion of some deposits renders a lower deposit insurance premium valid. However, as long as all deposits have equal seniority, excluding deposits does not lower the per insured deposit premium of deposit insurance. This section explains why this is the case.

For now, assume for simplicity that all bank debt are deposits. The premium expressed as percentage of insured deposits is dependent on the amount of total deposits of the bank – not on the amount of insured deposits, as long as the seniority of all

[18] Chan, Greenbaum and Thakor (1992) show that, when banks hold nontraded private-information assets, it is impossible to implement a risk-sensitive deposit insurance pricing scheme that is incentive compatible unless banks earn rents or are subsidized by the regulator. Giammarino, Lewis, and Sappington (1993) show that banks' asset quality is below the first-best level under a socially optimal deposit insurance scheme. Kanatas (1986) suggests to overcome such informational asymmetry problems by using a banks' access to discount window credit to reveal their asset quality, and proposes to integrate risk-based deposit insurance pricing with discount window policy. On the other hand, Craine (1995) shows that, if there exist intermediaries that hold traded public-information securities and that are allowed to issue insured deposits, an efficient separating equilibrium can be reached by separating the market for insured deposits from private-information financial intermediation.

deposits (insured plus not insured) is equal. This means that for a given amount of deposits, the actuarially fair deposit insurance premium per dollar of insured deposits is constant. Of course, the total amount of deposit insurance premium varies with the amount of insured deposits on a one-to-one basis. In other words, if bank debt equals deposits D, the per dollar deposit insurance premium is a function of total deposits, denoted g, and the total value of deposit insurance, denoted G, is a function of insured deposits D_I. Formally, $g = g(D)$, and $G = gD_I = g(D)D_I$.

More generally, if the bank issues non-deposit debt, but all debt can be considered a single-homogeneous debt, as assumed in Merton (1977), then the per-dollar deposit insurance premium depends on total debt, not on total (insured) deposits. To see this, let V be the unobserved post-insurance value of the bank's assets, B_1 the face value of the insured deposits, B_2 the face value of all debt liabilities other than the insured deposits, $B = B_1 + B_2$ the face value of total debt liabilities, σ_V the instantaneous standard deviation of the return on bank's assets, and T the time until next audit of the bank's assets. Now, assuming all pre-insurance debt to be of equal seniority, holders of deposits would be entitled to either the future value of their deposits, or to a pro-rated fraction of the value, should the value be less than total debt. In other words, the deposit holders will receive $\min\left\{FV(B_1), \frac{V_T B_1}{B_1 + B_2}\right\}$ upon maturity of the debt, where $FV(.)$ denotes the future value operator, and V_T is the terminal value of the bank's assets. Thus, the maturity value of deposit insurance is given by $\max\left\{0, FV(B_1) - \frac{V_T B_1}{B_1 + B_2}\right\}$.

Then, following Merton (1977), the value of the insurance is equivalent to the value of a put, written with a striking price equal to *total* debt, and then scaled down by the proportion of demand deposits to total debt, B_1 / B. To see this, note that the deposit insurance value, denoted P, is given by

$$P = B_1 \Phi(h + \sigma_V \sqrt{T}) - \frac{VB_1}{B_1 + B_2} \Phi(h) \tag{11}$$

where $h = \dfrac{\ln\left(\dfrac{B_1}{VB_1/(B_1+B_2)}\right) - \sigma_V^2 T/2}{\sigma_V \sqrt{T}} = \dfrac{\ln\left(\dfrac{B}{V}\right) - \sigma_V^2 T/2}{\sigma_V \sqrt{T}}$ and $\Phi(.)$ is the cumulative density function of a standard normal random variable. And, therefore, the per dollar deposit insurance premium, denoted g, with $g = P/B_1$, is then given by

$$g = \Phi(h + \sigma_V \sqrt{T}) - \frac{V}{B}\Phi(h) \ , \tag{12}$$

where $h = \dfrac{\ln\left(\dfrac{B}{V}\right) - \sigma_V^2 T/2}{\sigma_V \sqrt{T}}$ (RV, 1986). Note, that the per-dollar deposit insurance premium does not depend directly on the risk-free rate of interest.

From the above it follows that excluding certain deposits (for example, foreign-currency deposits) from deposit insurance coverage reduces proportionally the deposit insurance cost, but does not affect the actuarially fair deposit insurance premium (expressed as percentage of insured deposits), unless not covering certain deposits, such as foreign-currency deposits, affects the asset composition of the bank and with it the asset risk σ_V of the bank. In reality, however, a reduction in insurance coverage is likely to reduce moral hazard and may therefore reduce the asset risk of the bank and the actuarially fair deposit insurance premium.

In developing countries, banks' asset risk, σ_V, tends to be higher on average than in developed countries. Since the per dollar insurance premium is higher with higher asset risk, limiting the coverage has a larger impact on reducing the total value of deposit insurance in countries with high bank asset risk than in countries with low bank asset risk. Limiting the coverage of deposit insurance is therefore an even more important tool for controlling moral hazard and the cost of deposit insurance in most developing countries than in most developed countries.

Depending on the percentage of the value of total deposit covered by the deposit insurance fund, the premium expressed per insured deposits can differ substantially from the premium expressed per total deposits, as illustrated by Table 6. For countries that do not report official premium as a percentage of insured deposits, but only as a percentage of total deposits, we use reported figures on the deposit coverage to translate the reported premiums in estimates of the premiums expressed as a percentage of insured deposits. The deposit coverage and premium data used to perform these transformations are also reported in Panel B respectively Panel C of the Annex. Due to data limitations, we cannot calculate the official premiums as a percentage of insured deposits for all countries. Table 6 only includes those countries for which the premium as a percentage of insured deposits can be calculated. Column 2 in Table 6 shows whether the insured deposits or total deposits (insured plus uninsured deposits) are the premium assessment base. Column 3 presents annual premiums for flat rate deposit insurance schemes as a percentage of the assessment base, and as reported by country authorities. Column 4 shows the value of deposit insurance coverage as a percentage of total deposits. Column 5 presents annual premiums as a percentage of insured deposits. The table illustrates that it is important to know the assessment base of the premiums, when looking at officially charged deposit insurance premiums.

Table 6 Premium per insured deposit

Column 2 presents the premium assessment base. Column 3 presents annual premiums for flat rate deposit insurance schemes as a percentage of the assessment base. Column 4 shows the value of deposit insurance coverage as a percentage of total deposits. Column 5 presents annual premiums as a percentage of insured deposits. Source: Annex of this paper.

Country	Assessment base For premium	Premium % of assessment base	Deposit coverage % of value of total deposits	Premium % of insured deposits
Argentina	Insured deposits	0.66 to 1.02	40.0	0.66-1.02
Bahamas	Insured deposits	0.05	11.5	0.05
Bangladesh	Total deposits	0.01	31.0	0.02
Belgium	Insured deposits	0.02	n.a.	0.02
Brazil	Total deposits	0.30	43.0	0.70
Bulgaria	Insured deposits	0.50	<35.0	0.50
Canada	Insured deposits	0.04 to 0.33	35.9	0.04 to 0.33
Croatia	Insured deposits	0.80	68.0	0.80
Czech Rep.	Insured deposits	0.50	n.a.	0.50
Denmark	Insured deposits	Max. 0.20	<50.0	Max. 0.20
Finland	Insured deposits	0.05 to 0.30	40.0	0.05 to 0.30
Germany	Insured deposits	0.01-0.11	n.a.	0.01-0.11
Guatemala	Insured deposits	1.00	n.a.	1.00
Hungary	Insured deposits	0.16-0.19	48.0	0.16-0.19
Iceland	Insured deposits	0.15	n.a.	0.15
India	Total deposits	0.05	72.0	0.07
Ireland	Insured deposits	0.20	n.a.	0.20
Jamaica	Insured deposits	0.10	33.5	0.10
Japan	Insured deposits	0.08	100.0	0.08
Kazakhstan	Insured deposits	0.13-0.38	n.a.	0.13-0.38
Kenya	Total deposits	0.15	16.0	0.94
Korea	Total deposits	0.05	100.0	0.05
Latvia	Insured deposits	0.30	18.7	0.30
Lithuania	Insured deposits	1.00	44.0	1.00
Macedonia	Insured deposits	0.01-0.03	99.0	0.01-0.03
Mexico	Total deposits	0.40-0.80	100.0	0.40-0.80
Nigeria	Total deposits	0.94	21.0	4.46
Peru	Insured deposits	>0.65	n.a.	>0.65
Portugal	Insured deposits	0.08 to 0.12	n.a.	0.08 to 0.12
Romania	Insured deposits	0.30 to 0.60	n.a.	0.30 to 0.60
Slovak Rep.	Insured deposits	0.10 to 0.30	47.0	0.10 to 0.30
Spain	Insured deposits	0.10	60.0	0.10
Sweden	Insured deposits	Max. 0.50	n.a.	Max. 0.50
Taiwan	Insured deposits	0.05-0.06	45.0	0.05-0.06
Tanzania	Total deposits	0.10	12.0	0.83
Trinidad & Tobago	Total deposits	0.20	34.1	0.59
Turkey	Insured deposits	1.00-1.20	100.0	1.00-1.20
Uganda	Total deposits	0.20	26.0	0.77
Ukraine	Total deposits	0.50	19.0	2.63
United Kingdom	Insured deposits	<0.30	n.a.	<0.30
United States	Insured deposits	0.00-0.27	65.2	0.00-0.27
Venezuela	Insured deposits	2.00	n.a.	2.00

Deposit insurance coverage differs substantially across countries. Coverage limits average 20,660 US dollars per deposit for all countries, but range from as low as 120 US dollars in the Ukraine to as high as 243,520 US dollars in Norway. Insurance coverage tends to increase with the level of economic development of the country. Naturally, coverage levels are expected to be higher in countries with higher levels of economic development. When controlling for differences in the level of per capita GDP, there is less variation in coverage across countries. The coverage limit-to-per capita GDP ratio averages 3.19 for all countries, 1.98 for developed countries, and 3.78 for developing countries.

The higher coverage in developed countries would suggest that the price of deposit insurance is higher in these countries, unless these countries are more effective in controlling the moral hazard arising from a high level of coverage. For example, these countries may be more inclined to install risk-adjusted insurance premiums, co-insurance, and/or private funding and administration. In what follows we analyze in more detail whether countries with high insurance coverage tend to be countries with high income levels, and whether these countries are more inclined to implement design features of deposit insurance systems that tend to limit moral hazard, such as risk-adjusted insurance premiums, co-insurance, and/or private funding and administration.

First, we regress the insurance coverage limit on per capita GDP and several design features. The design features are the age of the deposit insurance scheme, a variable that indicates whether the scheme involves co-insurance or not, a variable that indicates whether premiums are risk-adjusted or not, a variable that indicates whether the source of funding is private or not, and a variable that indicates whether the fund administration is private or not. We include per capita GDP to control for the level of economic development. The sample includes all countries with explicit deposit insurance schemes as of end-2000. The results are presented in column (1) of Table 7. The table also presents the correlation matrix of the design features.

The findings confirm that coverage limit tends to increase with per capita GDP. We also find that coverage tends to higher in countries where deposit insurance has been introduced a long time ago. However, the age of the deposit insurance fund is also strongly correlated with per capita GDP, suggesting that deposit insurance has been around for longer on average in rich countries than in poor countries. Next, we find that coverage tend to be higher in countries that have installed risk-adjusted premiums. Given the difficulty of implementing risk-adjusted premiums, one would expect that they tend to be more common in developed countries that in developing countries. However, the correlation matrix does not suggest such a relation. Private funding and administration are not significantly related to insurance coverage in the regression results, although the correlation between coverage limit and private fund administration is positive and significant.

Next, we use the deposit insurance coverage-to-per capita GDP ratio as dependent variable. Interestingly, we find that the coverage ratio is negatively associated with per capita GDP, suggesting that although coverage increases with per capita GDP, the rate of increase in coverage is lower than the rate of increase in per capita GDP. In other words, once we control for the level of economic development, we actually find that the insurance coverage is less generous in rich countries than in poor countries. We also find that countries with high coverage ratios tend to implement risk-adjusted premiums, suggesting that these countries try to curb the moral hazard arising from the generous level of insurance coverage. The other design features do not appear to be significantly associated with the coverage ratio.

We thus find that (i) deposit insurance coverage is higher in rich countries, but that (ii) once one controls for the level of economic development, deposit insurance coverage is more generous in poor countries, and (iii) that countries with generous levels of coverage tend to limit the cost of deposit insurance through adjusting insurance premiums for risk.

Table 7 Coverage limit as a function of deposit insurance design features

Panel A presents the regression results of coverage limit as a function of design features. Panel B presents the correlation matrix of several design features for countries with explicit deposit insurance as of end-year 2000. Dependent variable in column 1 is the coverage limit expressed in thousands of US dollars. Dependent variable in column 2 is the coverage limit divided by per capita GDP, also referred to as the coverage ratio. Per capita GDP is expressed in thousands of US dollars. Age of the scheme refers to the age of the deposit insurance scheme and is calculated as 2000 minus the year when deposit insurance was enacted. Co-insurance takes value of one if there is co-insurance, and zero if not. Risk-adjusted premiums takes value of one if premiums are risk-adjusted, and zero if not. Private funding takes value of one if the source of funding is private, and zero if not. Private administration takes value one if the fund administration is private, and zero otherwise. Source of the data is Garcia (2000) and Demirgüç-Kunt and Sobaci (2001). The data are presented in the Annex to this paper. The number of country observations is 67. Six countries are deleted from the sample due to lack of data on any of the regression variables. The remaining sample is 61 countries. The correlation matrix is based on the total sample of 67 countries. A constant term was included, but is not reported. Heteroskedasticity-constistent standard errors between brackets. * indicates significance at a 10% level. ** indicates significance at a 5% level. *** indicates significance at a 1% level.

Panel A: Regression results

	Coverage limit (1)	Coverage limit-to-per capita GDP (2)
Per capita GDP	***1.546	***-0.098
	(0.466)	(0.028)
Age of the scheme	**0.594	0.004
	(0.293)	(0.027)
Co-insurance	-1.079	-0.668
	(7.657)	(0.663)
Risk-adjusted premiums	**13.366	**2.200
	(5.813)	(0.988)
Private funding	-23.668	0.179
	(14.960)	(0.650)
Private administration	15.135	0.214
	(12.661)	(0.735)
R2	0.482	0.202
No. observations	61	61

Panel B: Correlation matrix

	Coverage limit	Coverage ratio	Per capita GDP	Age of scheme	Co-insurance	Risk-adjusted	Private funding	Private admin.
Coverage limit	1.00							
Coverage ratio	0.14	1.00						
Per capita GDP	***0.58	**-0.28	1.00					
Age of scheme	***0.43	-0.12	***0.45	1.00				
Co-insurance	0.02	-0.09	0.09	-0.09	1.00			
Risk-Adjusted	**0.26	**0.27	0.11	0.03	-0.07	1.00		
Private funding	0.02	-0.17	***0.41	0.08	**0.31	-0.06	1.00	
Private admin.	***0.40	-0.07	***0.47	**0.26	0.09	*0.21	**0.26	1.00

2.3 Risk diversification, risk differentiation and pricing of deposit insurance

It is well-known from investment portfolio theory that non-systemic risk can be diversified away by pooling different assets into one portfolio (see, for example, Markowitz 1952). The risk diversification value of an additional asset relates linearly to the covariance between the returns on the additional asset and the asset returns of the portfolio. The deposit insurance analogue to portfolio diversification is that, unless bank equity returns are perfectly correlated, the price of deposit insurance of a group of banks is lower than the sum of the price of deposit insurance for each individual bank. The risk diversification potential of a particular bank is greater if the correlation between its equity returns and the equity returns of the other banks in the group is lower.

More generally, the actuarial cost of insurance decreases with the pool of underlying assets. If default probabilities are not perfectly correlated, it is cheaper to insure a large pool of assets than a small pool of assets. A larger pool of assets is also more likely to be insurable, because losses occur with a higher degree of randomness and more frequently, and the average loss amount upon loss occurrence is smaller (see Berliner, 1982).

The issue of potential diversification of non-systemic risk is often overlooked when discussing appropriate pricing levels for deposit insurance in a country. Typically, the actuarially-fair price of deposit insurance for a country is estimated by averaging estimated actuarially fair deposit insurance premiums of individual banks in the country. From the above, it follows that the cost of insuring the deposits of a banking system is lower than the sum of the cost of insuring each bank individually. The difference between the cost of insuring the system and the sum of the individual parts is greater if there is greater risk diversification potential in the country. Naturally, the potential for risk diversification is larger in larger countries, in countries with many banks, and in countries with different types of banks (other things being equal). Therefore, the deposit insurance premium should be higher (or the insurance coverage smaller) in small countries, in countries with few banks, and in countries without substantial differentiation between banks (and their risk-characteristics).

A more direct way to limit the risk of deposit insurance, and therefore its price, is to exclude risky banks from the insurance contract. Unless some of these banks have great diversification potential because of their covariance matrix structure, and exclusion of the risky banks from insurance can reduce the cost of deposit insurance significantly. Of course, the success of this risk differentiation approach depends on the technical ability and political will to differentiate between risky banks and not so risky banks.

In this section, we investigate the potential of risk diversification and risk differentiation of banks in the Republic of Korea. We compare RV (1986) estimates of actuarially fair deposit insurance premiums for individual banks with their equivalent for a group of listed banks in Korea. The reasons for focusing on Korea are threefold. First, to apply the RV (1986) methodology, we need data on bank equity returns. Most commercial banks in Korea are listed and data on their equity returns are readily available. Second, and most importantly, the majority of the Korean commercial banking system consists of listed banks, so that the portfolio of listed banks is a good proxy for the overall commercial banking system. Ideally, one would want to look at all banks in the country when assessing the potential of risk diversification in the country. Unfortunately, there is no country where all banks are listed. Korea is one of the best case studies from this perspective.

We collect daily market data and annual balance sheet data on all listed commercial banks in Korea for the year 1999 from Bankscope and Datastream. Data on the total commercial banking system come from the Korean Central Bank. A summary of the data is presented in Table 8. We estimate annual equity volatility from weekly equity returns expressed in US dollars, and follow Fama's (1965) suggestion to delete days when the Korean stock exchange is closed. We also delete observations for days on which large jumps in share prices occur. Such observations may be due to restructuring or merger announcements. Inclusion of such observations would overestimate the volatility of equity returns.

Table 8 confirms that the group of listed banks comprises a large part of the total commercial banking system in Korea. In terms of total assets, the thirteen listed commercial banks in Korea account for 81.8 percent of total commercial banking system assets. The share of listed banks in total commercial bank deposits is even slightly higher with 82.5 percent. This means that the group of listed banks in Korea is a reasonable proxy for the entire commercial banking system in Korea, so that the risk diversification potential embedded in the group of listed banks (and the corresponding saving in the cost of deposit insurance) approximates the risk diversification potential of the country.

The average equity volatility weighted by equity market values is 80.1 percent, which is substantially larger than the equity volatility of the portfolio of stocks of the thirteen listed banks reported in Table 8 of 56.2 percent. The total equity volatility is lower than the average equity volatility due to imperfect correlation of the equity returns of the sampled banks.

Table 9 presents the correlation matrix between the equity returns. The table shows that there is a large variation in the equity return correlations of different banks. Some equity return correlations are close to zero.[19] These correlations suggest that the potential for risk diversification among Korea banks is substantial.[20]

This is confirmed when we compare RV (1986) estimates of actuarially fair deposit insurance premiums for the individual banks with their equivalent for the total group of listed banks in Korea. Table 10 shows that the average actuarially fair premium for listed banks is 2.81 percent of deposits (weighted by total deposits), while the actuarially fair premium of insuring the portfolio of all banks is only 1.44 percent of deposits. The total value of deposit insurance drops from 8.3 billion US dollars to 4.2 billion US dollars. In other words, diversifying non-systemic risk by insuring the deposits of all banks via the same contract (a typical explicit deposit insurance contract) almost halves the deposit insurance premiums, as compared to insuring banks via individual contracts.

In estimating actuarially fair deposit insurance premiums, we assume a forbearance parameter of 0.95. This is slightly lower than the corresponding figure of 0.97 in RV (1986). Our setup is intended to reflect the difference in the expected level of forbearance between the US, the country under investigation in RV (1986), and Korea. The Republic of Korea recently experienced a financial crisis and has arguably a weaker level of government enforcement and greater fiscal weakness than the US.

Next, we investigate the potential for risk reduction achieved by excluding the three riskiest banks in terms of equity volatility from the insurance contract. These three banks

[19] For example, the correlation between the equity returns of Korea First Bank and Kyongnam Bank is only 0.08, and the correlation between the equity returns of Korea First Bank and Housing and Commercial Bank is even slightly negative at –0.02.

[20] As the equity return correlations are unlikely to be stable over time, our quantitative results are sensitive to the sampled time period. However, our qualitative result does not alter.

are highlighted in italics in Table 8 and include Hanvit Bank (with an equity return volatility of 90 percent), Korea First Bank (with an equity return volatility of 120 percent) and Seoul Bank (with an equity return volatility of 124 percent). The share of the remaining ten banks in the assets of the total Korean commercial banking system drops to 58 percent. Note that one of these banks, Korea First Bank, is a bank with large risk diversification potential, as reflected by the low correlation of its equity returns with some of the other Korean banks. Nevertheless, we find that exclusion of these banks of above-average risk further reduces the risk of the portfolio and therefore the actuarially fair deposit insurance premium. The estimate of the actuarially fair deposit insurance premium for the portfolio of ten remaining banks is 1.28 percent of deposits.

The above mentioned actuarially fair deposit insurance premiums have been estimated under the assumption that all debt is insured. Next, we carry out an extreme debt-structure experiment where we assume that all non-deposit debt is subordinated to deposits.[21] Although in reality it is quite likely that all bank creditors in Korea were implicitly guaranteed by the government during the year 1999, so that insured bank debt equals total bank debt, this experiment highlights the potential reduction in costs if insurance and bailouts were to be strictly limited to bank deposits, and non-deposit creditors hold junior debt.

With non-deposit debt subordinated, the estimated actuarially fair deposit insurance premiums reduce further. Under this setup, insuring the deposits of the thirteen banks carries a price of only 0.39 percent of deposits (see column 4 in Table 10). When the three "risky" banks are excluded, the estimated actuarially fair premium further reduces to 0.33 percent of deposits. The latter is dramatically lower than the original weighted average of 2.81 percent of deposits.

This section has shown that the potential for risk diversification should be taken into account when considering an appropriate level for the deposit insurance premium of a country. Countries with little diversification of risk should charge higher deposit insurance premiums. We have also shown that premiums can be set substantially lower if countries (have the option to) exclude risky banks from the deposit insurance system.

[21] In other words, we assume that non-deposit debt is junior to the deposit insurance agency claim and we classify such debt as equity. In effect, the bank's debt is made coterminous with deposits, and therefore the price of deposit insurance is reduced. See also Hovakimian and Kane (2000).

Table 8 Korean bank data as of end-1999

The following table shows bank-specific data for listed banks in the Republic of Korea as of end-1999. Values are in millions of US dollars, unless otherwise noted. Equity volatility is annualized volatility, based on weekly equity returns (i.e., weekly equity volatility times the square root of 52). In italics are the banks the three riskiest banks according to equity volatility. Individual bank data come from Bankscope and Datastream. Total commercial banking system data from the Korean Central Bank. Column (1) presents total banks assets. Column (2) presents bank deposits. Column (3) presents total bank debt. Column (4) presents the market value of equity. Column (5) presents the volatility of equity. Column (6) shows the dividend paid. Column (7) presents the debt-to-equity ratio. Column (8) presents the ratio of deposits to (equity plus non-deposit debt), also equal to the ratio of deposits to (assets minus deposits).

Bank Name	(1) Total Assets (mln US$)	(2) Deposits (mln US$)	(3) Total debt (mln US$)	(4) MV equity (mln US$)	(5) Equity volatility (%)	(6) Dividend paid (mln US$)	(7) Debt-over-Equity	(8) Deposits/ (Assets-Deposits)
Chohung Bank	40,815	29,910	38,900	2,200	69.8	0	17.7	2.7
Daegu Bank	10,352	8,190	9,874	344	68.6	0	28.7	4.0
H&C Bank	42,495	31,418	40,615	3,126	68.3	58.8	13.0	2.5
Hana Bank	32,088	25,251	30,408	854	79.2	45.5	35.6	4.2
Hanvit Bank	63,581	55,371	61,245	2,941	*90.4*	0	20.8	6.3
Kookmin Bank	63,715	46,692	60,652	4,670	72.3	14.8	13.0	2.5
Koram Bank	19,991	15,454	19,119	736	73.6	0	26.0	3.5
Korea First Bank	24,794	18,972	23,937	741	*120.0*	0	32.2	3.3
Kwangju Bank	6,179	4,966	6,051	150	77.9	0	40.4	4.0
Kyongnam Bank	7,059	5,393	6,743	163	80.5	0	41.4	3.6
Pusan Bank	8,773	7,564	8,422	194	79.1	0	43.5	7.2
Seoul Bank	21,203	18,178	20,290	325	*124.4*	0	62.3	7.5
Shinhan Bank	37,223	26,598	34,673	2,646	72.6	0	13.1	2.5
Total (13) all listed banks	378,267	293,957	360,928	19,088	56.2	119.1	18.9	3.4
Total commercial banking system	462,519	356,390						
Percentage of total system	81.8	82.5						
Total (10) excluding 3 riskiest banks	268,690	201,437	255,456	15,081	55.2	119.1	16.9	2.9
Percentage of total system	58.1	56.5						

Table 9 Correlation matrix of weekly equity returns in US dollars for the year 1999

This table presents the correlation matrix of equity returns for listed banks in the Republic of Korea. Correlations are based on weekly stock returns in US dollars for the year 1999.

	Chohung	Daegu	Hana	Hanvit	H & C	Kookmin	Koram	Korea first	Kwangju	Kyongnam	Pusan	Seoul	Shinhan
Chohung	1.00												
Daegu	0.53	1.00											
Hana	0.46	0.59	1.00										
Hanvit	0.39	0.42	0.58	1.00									
H & C	0.26	0.48	0.50	0.41	1.00								
Kookmin	0.46	0.63	0.61	0.59	0.63	1.00							
Koram	0.41	0.65	0.76	0.56	0.60	0.71	1.00						
Korea first	0.45	0.33	0.18	0.17	-0.02	0.23	0.32	1.00					
Kwangju	0.56	0.78	0.52	0.47	0.46	0.69	0.57	0.31	1.00				
Kyongnam	0.45	0.75	0.39	0.33	0.45	0.61	0.50	0.08	0.80	1.00			
Pusan	0.46	0.81	0.46	0.39	0.25	0.53	0.53	0.29	0.81	0.74	1.00		
Seoul	0.56	0.42	0.20	0.31	0.18	0.35	0.39	0.80	0.42	0.32	0.35	1.00	
Shinhan	0.46	0.58	0.67	0.42	0.51	0.68	0.72	0.28	0.55	0.49	0.39	0.30	1.00

Table 10 Effect of risk diversification and exclusion of risky banks on deposit insurance premiums

This table presents RV (1986) estimates of actuarially fair deposit insurance premiums for Korean banks. These values of the deposit insurance guarantee are expressed in US dollars and as a percentage of deposits. We assume a forbearance parameter of ρ=0.95, and a constant annual dividend yield. Individual bank data from Bankscope and Datastream. Data are as of end-1999. The implied premiums in columns (2) and (3) assume that all bank debt is insured. The implied premiums in columns (4) and (5) assume that non-deposit bank debt is subordinated and set equal to equity, as in Hovakimian and Kane (2000, Table V). Panel A presents the weighted average premium for all banks (weighted by bank deposits) and the implied premium for the portfolio of all banks. Panel B excludes the three most risky banks according to their equity volatility, i.e., Hanvit Bank, Korea First Bank, and Seoul Bank. Panel B presents for this sub-sample of banks the weighted average premium (weighted by bank deposits) and the implied premium for the portfolio of these banks.

	(1)	(2)	(3)	(4)	(5)
		All bank debt is insured		Non-deposit bank debt is subordinated	
Bank Name	Deposits (mln USD)	Insurance premium (in % of deposits)	Value of deposit insurance (mln USD)	Insurance premium (in % of deposits)	Value of deposit insurance (mln USD)
Chohung Bank	29,910	1.52	455	1.01	303
Daegu Bank	8,190	2.07	170	0.98	80
H&C Bank	31,418	1.86	585	1.07	338
Hana Bank	25,251	6.84	1,726	2.89	729
Hanvit Bank	*55,371*	*2.71*	*1,503*		
Kookmin Bank	46,692	1.52	712	1.28	599
Koram Bank	15,454	2.11	326	1.34	206
Korea First Bank	*18,972*	*5.10*	*967*		
Kwangju Bank	4,966	2.84	141	1.72	85
Kyongnam Bank	5,393	2.93	158	1.99	107
Pusan Bank	7,564	2.98	226	1.78	135
Seoul Bank	*18,178*	*5.01*	*910*		
Shinhan Bank	26,598	1.46	388	1.22	324
Panel A: All banks					
Weighted average		2.81	8,265	2.73	8,221
Total (13 banks)	293,957	**1.44**	**4,228**	**0.39**	**1,146**
Panel B: Excl. risky banks					
Weighted average		2.43	4,886	1.43	2,906
Total (10 banks)	201,437	**1.28**	**2,570**	**0.33**	**671**

3. Is Deposit Insurance Underpriced Around the World?

The ultimate question on the pricing of deposit insurance in a particular country is whether deposit insurance is priced correctly. In this section we employ some of the methods presented in section 1 to address this question. More specifically, we focus on the option-pricing method and the expected loss pricing method. Since the outcome of over- or underpricing is highly sensitive to the model specifications, we choose the model parameters such that these alternative models give "conservative" estimates, i.e., estimates that are likely to underestimate the true cost of deposit insurance.

In the case of option-pricing models, we generate conservative estimates of the price of deposit insurance by not allowing for regulatory forbearance. As mentioned in section 1.1, there exist several reasons why Merton's (1977) option-pricing model of deposit insurance gives downward biased estimates of the benefits bank stockholders derive from the safety net. One possible reason is that the level of regulatory forbearance is underestimated. Although RV (1986) incorporate capital forbearance by the bank regulators by permitting asset values to deteriorate to 97 percent of the value of bank debt before the bank is closed, the level of regulatory control is unknown ex ante. It is quite plausible that the level of regulatory forbearance is much higher in certain countries, notably developing countries, than suggested by the setup in the RV (1986) model, where a forbearance parameter of 0.97 is assumed. Other reasons why the option-pricing model is likely to give downward biased estimates of the price of deposit insurance are the assumption of prompt option settlement and the assumption that no agency conflicts arise from the enforcement of regulatory requirements. For these reasons, we argue that the RV (1986) model without capital forbearance generates conservative estimates of the actuarially fair price of deposit insurance. For comparison purposes, we also use the RV (1986) model with a forbearance parameter of 0.97 to get less conservative estimates of the actuarially fair price of deposit insurance.

In the case of expected loss pricing methods, we generate conservative estimates of the price of deposit insurance by assuming low loss rates on bank assets. More specifically, we set the loss rate on bank assets equal to the US historical average of 8 percent, which is likely to be a too low figure for most countries, in particular for countries with a weak insolvency framework such as many developing countries. We use country and bank credit ratings to generate estimates for the expected loss rates. The basic setup is identical to the one presented in Table 4, Panel A in Section 1.

A consistent comparison of cross-country premiums should be based on deposit insurance premiums expressed as a percentage of insured deposits, because this figure does not depend on the deposit coverage, but only on the amount of total debt. Depending on the percentage of the value of total deposit covered by the deposit insurance fund, the premium expressed per insured deposits can differ substantially from the premium expressed per total deposits. We use the official premiums (re)stated as a percentage of insured deposits and reported in Table 6.

The procedure for transforming credit ratings into expected loss rates has already been explained in great detail in section 1. Table 11 presents estimates of the expected loss rates for different categories of Moody's credit ratings using loss rates on assets of 8 percent or 50 percent. The 8 percent loss rate represents the US historical average. The expected losses loss rates presented in Table 11 are generated using the same framework and under the same assumptions as those presented earlier in Panel A of Table 4 in Section 1. Column (3) in Table 11 presents the expected loss rates under the assumption of loss rates on assets of 8 percent, while column (4) presents the expected loss rates under the assumption of loss rates on assets of 50 percent. The estimates in column (3) serve as a conservative estimate of the actuarially fair premium of deposit insurance. The estimates in column (4) are less conservative. The estimates in column (3) and (4) differ only in the assumed loss rate on assets. Since expected loss rates are proportional to the loss rates on assets (other things equal), the expected loss rates calculated under the assumption of 50 percent loss rates on assets are 50-over-8 times higher than the expected losses calculated under the assumption of 8 percent loss rates on assets.

The expected loss rates per deposit derived under the assumption of the US historical average loss rate on assets of 8 percent and presented in Table 11 show a similar range of values as the actual assessment rates of FDIC-insured deposit-taking institutions in the US. Table 12 presents the assessment rates for such institutions for the year 2001 by supervisory group and capital group. Supervisory group A denotes better quality than supervisory group B, and group B denotes better quality than group C.[22]

Table 11 Expected Loss Pricing using Credit Ratings

Column 3 reports expected loss rates by credit rating under the assumption of a 8 percent loss rate on assets and a deposit to assets ratio of 75 percent. Column 3 reports expected loss rates by credit rating under the assumption of a 50 percent loss rate on assets and a deposit to assets ratio of 75 percent. The "Average cumulative default rate for 5 years (1920-99)" is taken from Exhibit 31, Moody's Historical Default Rates of Corporate Bond Issuers, 1920-1999, January 2000. The 8 percent loss rate on assets equals the historical loss rate on assets for US banks with assets larger than US$ 5 billion, and is taken from US, FDIC (2001).

Moody's credit rating	(1) Average cumulative default rate for 5 years (1920-99)	(2) Deposits/Assets	(3) Expected loss 8% loss rate on assets (% of deposits)	(4) Expected loss 50% loss rate on assets (% of deposits)
Aaa	0.20%	75.00%	0.00%	0.03%
Aa1-Aa3	0.36%	75.00%	0.01%	0.05%
A1-A3	0.55%	75.00%	0.01%	0.07%
Baa1-Baa3	1.97%	75.00%	0.04%	0.26%
Ba1-Ba3	12.88%	75.00%	0.27%	1.72%
B1-B3	30.16%	75.00%	0.64%	4.02%
Caa1-C3	43.37%	75.00%	0.93%	5.78%

While the FDIC premiums range from zero to 0.27 percent of insured deposits, the Moody's ratings implied premiums (under the assumption of 8 percent loss rates) range from zero to 0.93 percent of insured deposits. Considering that the Moody's ratings of large banks in the US range from Aa to Ba, the Moody's ratings implied premiums for a significant part of the US banking system range from 0.1 percent to 0.27 percent of insured deposits, very similar to the actual FDIC pricing schedule of 0.0 percent to 0.27 percent of insured deposits. These results do not indicate that deposit insurance is priced correctly in the US, but merely seem to suggest that the expected loss pricing method gives reasonable estimates of the price of deposit insurance.

[22] As defined by the FDIC: Supervisory group A consists of financially sound institutions with a few minor weaknesses and generally corresponds to the primary federal regulator's composite rating of 1 or 2 (1 being the highest rating). Supervisory group B consists of institutions that demonstrate weaknesses, which, if not corrected, could results in significant deterioration of the institutions. This group generally corresponds to the primary federal regulator's composite rating of 3. Supervisory group C consists of institutions that pose a substantial probability loss to the deposit insurer unless effective corrective action is taken. This group generally corresponds to the primary federal regulator's composite rating of 4 or 5.

Table 12 Assessment Rate Schedule of FDIC-Insured Institutions, 2001

This table presents the assessment rate schedule of the U.S. FDIC risk-based assessment system as of end-2001. Assessment rates are by supervisory group and capital group. Rates are annual and are expressed in percentage points per insured deposits.

		Supervisory group		
		A	B	C
Capital group	Well-capitalized	0.00	0.03	0.17
	Adequately-capitalized	0.03	0.10	0.24
	Under-capitalized	0.10	0.24	0.27

Next, we compare the conservative estimates of the actuarially fair price of deposit insurance with the actually charged premiums in countries around the world. If the conservative estimate of the true cost of deposit insurance is higher than the officially charged premium, we argue that deposit insurance is underpriced. Table 13 presents both the official premiums and the conservative estimates of actuarially fair premiums based on credit ratings and option prices. We use both country and bank credit ratings from Moody's to estimate expected loss rates. The country credit rating acts as a ceiling of the rating for (most) banks in the country. In several countries, country risk is so dominant that bank ratings equal the country rating. Since we focus on expected loss rates on bank deposits we use the Moody's ratings for long-term bank deposits. For countries, we use Moody's ratings on foreign-currency denominated long-term bank deposits. For individual banks, we use Moody's ratings on long-term bank deposits (including both local-currency and foreign-currency denominated deposits).[23]

Column (1) in Table 13 presents the country rating on foreign-currency denominated, long-term bank deposits. Column (2) presents the median of the ratings on long-term bank deposits for individual banks. The median is taken across Moody's universe of rated banks in the country (see Moody's, 2001). Column (3) reports the actually charged deposit insurance premiums in the country. These official premiums are expressed as a percentage of insured deposits, and are taken from Table 6.

[23] Moody's deposit obligations ratings are issuer (rather than issue) ratings. For US banks, this rating applies only to domestic deposit obligations. For non-US banks, the deposit obligation rating applies to all deposit obligations.

The next four columns in Table 13 present the credit rating implied estimates of the price of deposit insurance. Column (4) presents the country credit rating implied premium under the assumption of a 8 percent loss rate on assets. The country credit rating is also expressed as a percentage of insured deposits. For consistency with the actual premiums, all implied premiums are expressed as a percentage of insured deposits. The country rating implied premiums in column (4) are our most conservative estimates of the actuarially fair price of deposit insurance, because they assume a low loss rate on assets of 8 percent and because they use the credit rating of the country which is at least as good as the (median) credit rating of banks in the country. Column (5) presents the bank credit rating implied estimates of the actuarially fair deposit insurance premium under the assumption of a 8 percent loss rate on assets. This country-level estimate is a weighted average of the bank credit rating implied estimates for individual banks in Moody's universe of rated banks in the country. These estimates correspond therefore to the default probabilities implied by the median bank credit ratings presented in column (2). Column (6) presents the country credit rating implied premium under the assumption of a 50 percent loss rate on assets. These estimates differ from the estimates in column (4) only in the assumed loss rate, and are therefore a factor 50-over-8 larger than the implied premiums in column (4). Column (7) presents the bank credit rating implied estimates of the actuarially fair deposit insurance premium under the assumption of a 50 percent loss rate on assets. Similarly, these estimates are a factor 50-over-8 larger than the premiums in column (5). The implied premiums in columns (6) and (7) use higher loss rates on assets and are therefore less conservative than the estimates in columns (4) and (5), but possibly more realistic in the case of some countries.

The last two columns in Table 13 present the option-pricing implied estimates of actuarially fair deposit insurance premiums. Column (8) presents the RV (1986) estimates under the assumption of no forbearance (i.e., using a forbearance parameter of ρ=1.00). Column (9) presents the RV (1986) estimates under the assumption of substantial forbearance (equivalent to a forbearance parameter of ρ=0.97 in their model). The RV (1986) implied deposit insurance premiums are from Hovakimian, Kane and Laeven (2002). These estimates are based on stock market and balance sheet data on a sample of listed banks in each of the reported countries, and are averages for the period 1991-99. We do not have estimates for a number of countries due to lack of data.

Despite the fact that we calculate rather conservative estimates of the price of deposit insurance, we find that these estimates are still higher than the officially charged premiums in a number of countries. In the case of Bulgaria, India and Jamaica, the actually charged premiums are even lower than the country credit rating implied premiums reported in column (4) – our most conservative estimates of the cost of deposit insurance. In Korea and Romania, the actual premiums levied are lower than the premiums implied by median bank credit in the country reported in column (5).[24] Based on less conservative estimates of the cost of deposit insurance that assume a loss rate on assets of 50 percent (reported in columns (6) and (7)), one would conclude that deposit insurance is underpriced in a large number of countries, most of which are developing countries.

The actuarially fair deposit insurance premiums implied by the RV (1986) option-pricing model also suggest underpricing in several countries. When allowing for forbearance (to the equivalent ρ=0.97 in the RV model), the implied premiums are higher than the actual premiums in the following countries: Bangladesh, Brazil, Germany, Hungary, India, Japan, Kenya, and Korea. More conservative estimates based on the assumption of no forbearance still suggest underpricing of deposit insurance in Bangladesh, Brazil, India, Japan and Korea.

In sum, we find using two different methods of pricing deposit insurance that the actual premiums levied on banks are lower than the premiums implied by these theoretical models in many countries. Given that we have used different models and have set model parameters such that these models produce conservative estimates of the true cost of deposit insurance (in many countries, forbearance may well exceed the level implied by ρ=0.97, and loss rates on assets may well exceed 50 percent), one could argue that deposit insurance is underpriced in many countries around the world. In particular in

[24] These implied figures are likely to be underestimates of the true cost of deposit insurance in many countries, not only because we assume a low loss rate on assets of 8 percent, but also because rated banks tend to be the "better quality" banks in the country, so that the median rating would overestimate the average quality of bank assets.

most developing countries, where the ability to control bank risk tends to be weak, underpricing of deposit insurance is likely to be greater than estimated here.

For many countries, we find such high levels of actuarially fair premiums as 5 percent or more of deposits. Few banks would be able to afford such high deposit insurance premiums. Our estimates thus suggest that many of these countries cannot afford deposit insurance, in particular countries with weak banks and institutions. This is another way of saying that countries with weak institutions should not adopt explicit deposit insurance.

Table 13 Official Premiums and Conservative Estimates of Fair Premiums Based on Credit Ratings and Option Prices

Column (1) presents the country rating on foreign-currency denominated, long-term bank deposits as of end-year 2001. Column (2) presents the median of the ratings on long-term bank deposits for individual banks as of end-year 2001. The source of the credit ratings is Moody's Investors Service (2001). Column (3) reports the actually charged deposit insurance premiums in the country as a percentage of insured deposits. The source of these figures is Table 6. Column (4) presents the country credit rating implied premium as a percentage of insured deposits under the assumption of a 8 percent loss rate on assets. Column (5) presents the bank credit rating implied estimates of the actuarially fair deposit insurance premium as a percentage of insured deposits under the assumption of a 8 percent loss rate on assets. Column (6) presents the country credit rating implied premium as a percentage of insured deposits under the assumption of a 50 percent loss rate on assets. Column (7) presents the bank credit rating implied estimates of the actuarially fair deposit insurance premium as a percentage of insured deposits under the assumption of a 50 percent loss rate on assets. Column (8) presents the RV (1986) (RV) implied estimates of deposit insurance premiums as a percentage of insured deposits under the assumption of no forbearance. Column (9) presents the RV implied estimates of deposit insurance premiums as a percentage of insured deposits under the assumption of substantial forbearance (equivalent to a forbearance parameter of ρ=0.97). The source of RV (1986) implied deposit insurance premiums is Hovakimian, Kane and Laeven (2002). These are averages for the period 1991-99.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Credit Rating Implied Premium				Option Pricing Implied Premium	
Country	Country rating	Bank rating	Actual Premium	Country rating implied premium — 8% loss rate	Bank rating implied premium — 8% loss rate	Country rating implied premium — 50% loss rate	Bank rating implied premium — 50% loss rate	RV implied premium — no forbearance	RV implied premium — with forbearance
Argentina	Caa3	Caa3	0.66-1.02	0.93	0.93	5.78	5.78	0.36	0.58
Bahamas	A3	n.a.	0.05	0.01	n.a.	0.07	n.a.	n.a.	n.a.
Bangladesh	n.a.	n.a.	0.02	n.a.	n.a.	n.a.	n.a.	0.07	0.77
Belgium	Aaa	Aa3	0.02	0.00	0.01	0.03	0.05	n.a.	n.a.
Brazil	B2	B2	0.70	0.64	0.64	4.02	4.02	0.92	1.70
Bulgaria	B3	n.a.	0.50	0.64	n.a.	4.02	n.a.	n.a.	n.a.
Canada	Aa1	Aa3	0.04 to 0.33	0.01	0.01	0.05	0.05	0.01	0.14
Croatia	Ba1	Ba1	0.80	0.27	0.27	1.72	1.72	n.a.	n.a.
Czech Rep.	Baa1	Baa1	0.50	0.04	0.04	0.26	0.26	0.06	0.32
Denmark	Aaa	Aa3	Max. 0.20	0.00	0.01	0.03	0.06	0.09	0.18
Finland	Aaa	Aa3	0.05 to 0.30	0.00	0.01	0.03	0.06	0.01	0.11
Germany	Aaa	Aa3	0.01-0.11	0.00	0.01	0.03	0.05	0.00	0.15
Guatemala	Ba3	n.a.	1.00	0.27	n.a.	1.72	n.a.	n.a.	n.a.
Hungary	A3	A3	0.16-0.19	0.01	0.02	0.07	0.11	0.08	0.42
Iceland	Aa3	A3	0.15	0.01	0.01	0.05	0.05	n.a.	n.a.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Credit Rating Implied Premium				Option Pricing Implied Premium	
Country	Country rating	Bank rating	Actual Premium	Country rating implied premium — 8% loss rate	Bank rating implied premium — 8% loss rate	Country rating implied premium — 50% loss rate	Bank rating implied premium — 50% loss rate	RV implied premium — no forbearance	RV implied premium — with forbearance
India	Ba3	Ba3	0.07	0.27	0.27	1.72	1.72	0.19	0.60
Ireland	Aaa	A2	0.20	0.00	0.01	0.03	0.07	0.00	0.02
Jamaica	B1	n.a.	0.10	0.64	n.a.	4.02	n.a.	n.a.	n.a.
Japan	Aa1	A3	0.08	0.01	0.03	0.05	0.16	0.09	0.42
Kazakhstan	Ba3	Ba3	0.13-0.38	0.27	0.27	1.72	1.72	n.a.	n.a.
Kenya	n.a.	n.a.	0.94	n.a.	n.a.	n.a.	n.a.	0.71	1.02
Korea	Baa3	Ba1	0.05	0.04	0.20	0.26	1.27	0.28	0.85
Latvia	Baa3	Ba1	0.30	0.04	0.16	0.26	0.99	n.a.	n.a.
Lithuania	Ba2	n.a.	1.00	0.27	n.a.	1.72	n.a.	n.a.	n.a.
Macedonia	n.a.	n.a.	0.01-0.03	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mexico	Ba1	Ba1	0.40-0.80	0.27	0.27	1.72	1.72	n.a.	n.a.
Nigeria	n.a.	n.a.	4.46	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Peru	B1	B1	>0.65	0.64	0.64	4.02	4.02	0.35	0.67
Portugal	Aaa	A1	0.08 to 0.12	0.00	0.01	0.03	0.10	0.01	0.06
Romania	Caa1	Caa1	0.30 to 0.60	0.93	0.93	5.78	5.78	n.a.	n.a.
Slovak Rep.	Ba1	Ba1	0.10 to 0.30	0.27	0.27	1.72	1.72	n.a.	n.a.
Spain	Aaa	A1	0.10	0.00	0.01	0.03	0.07	0.05	0.07
Sweden	Aa1	Aa3	Max. 0.50	0.01	0.01	0.05	0.05	0.02	0.21
Taiwan	Aa3	A3	0.05-0.06	0.01	0.02	0.05	0.14	0.02	0.06
Tanzania	n.a.	n.a.	0.83	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Trinidad & Tobago	Ba1	n.a.	0.59	0.27	n.a.	1.72	n.a.	n.a.	n.a.
Turkey	B3	B3	1.00-1.20	0.64	0.64	4.02	4.02	n.a.	n.a.
Uganda	n.a.	n.a.	0.77	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Ukraine	Caa1	Caa1	2.63	0.93	0.93	5.78	5.78	n.a.	n.a.
United Kingdom	Aaa	A1	<0.30	0.00	0.01	0.03	0.11	0.01	0.09
United States	Aaa	Aa3	0.00-0.27	0.00	0.01	0.03	0.20	0.00	0.01
Venezuela	B3	B3	2.00	0.64	0.64	4.02	4.02	n.a.	n.a.

4. Summary and Concluding Remarks

In section 1, we have described alternative methods to price the value of deposit insurance. Each of these methods builds on one of two theoretical frameworks: Merton's (1977) option-pricing model or the expected loss pricing approach. The first approach relies on market information on equity values of banks and its application is therefore limited to listed banks and to countries with well-developed capital markets. The second approach can also be applied if market-based information is not available, for instance, by using accounting-based information or credit ratings. Of course, when applying the second approach to market-based information, such as yields on debentures issued by banks, its application is also limited by the availability and quality of information on such securities. For these reasons, practical models of pricing deposit insurance typically embed both market-based and accounting-based information. Nevertheless, the application of such market-based models is deemed to be important. Not only are these models to be preferred to models that do not use market information from a theoretical point of view, but they can also be used to create estimates of actuarially fair deposit insurance premiums for the banks in a particular country that could serve as a benchmark for the contributions of banks required to cover the expected losses from bank failures, even though such estimates are restricted to a limited sub-sample of all banks in the country. Given different values for the models input parameters, the tables in section 1 report estimates of such actuarially fair premiums. These tables can easily be used as ready-reckoners by policymakers to assess the adequateness of existing deposit insurance premiums for different banks.

The actuarially fair price of deposit insurance is affected by several structure and design features of a deposit insurance system. In section 2, we have presented several examples and studied several cases to document how different design features of deposit insurance affect its pricing structure. In particular, we have focused on the relation between deposit insurance coverage and the price of deposit insurance, and how risk diversification and risk differentiation within a deposit insurance system can reduce the price of deposit insurance.

In section 2, we have also drawn the attention to an issue that is often overlooked, namely the potential to diversify non-systemic risk among a pool of insured deposits of different banks. Because of such risk diversification, the cost of insuring the deposits of a banking system is lower than the sum of the cost of insuring each bank separately.

The discussions and findings in section 2 indicates which design features could help avoid the excessive costs arising from informational asymmetries and principal-agent problems that are associated with deposit insurance. However, the objective of governments that implement deposit insurance is generally not to minimize such costs, but rather to achieve social goals such as protecting small depositors or enhancing public confidence and stability of the financial system. Most of these objectives, however, can also be reached with limited cost of deposit insurance. Clearly, the design and implementation of a deposit insurance scheme should fit country-specific circumstances, but certain "good practices" arise that can substantially limit the cost of deposit insurance. To avoid adverse selection, membership of the deposit insurance scheme should be compulsory. To avoid moral hazard, deposit insurance premiums should be risk-adjusted, the insurance coverage should be low, prompt corrective actions should be taken against banks, and early intervention should take place in weak banks. The insurance coverage should aim at insuring the deposits of small depositors, and should exclude part of large deposits, inter-bank deposits, government deposits, and possibly foreign-currency deposits. Low coverage may be complemented with coinsurance for deposits larger than the smallest tranche of deposits.

The ultimate question on the pricing of deposit insurance in a particular country is whether deposit insurance is priced correctly. In section 3, we have investigated whether deposit insurance is underpriced in countries around the world using the different methodologies presented and discussed in section 1. We find that the actual premiums levied on banks are lower than the premiums implied by these theoretical models in many countries, and argue that deposit insurance is underpriced in many countries around the world, notably in several developing countries. These implied premiums also suggest that many countries cannot afford deposit insurance, in particular countries with weak banks and institutions, as the estimated fair premiums imply contributions by the banks in these countries that would be unreasonably high. It follows that countries with weak institutions should not adopt explicit deposit insurance.

Deposit insurance may not be a good recipe for each country, but for countries that do decide to adopt deposit insurance, pricing it as efficient as possible is important. This means that prices should be set such that they reflect the risk shifted to the deposit insurer. In order to facilitate the efficient pricing of risk, banks should be given the incentives to reveal the necessary information to assess their risk. In an effort to price deposit insurance more fairly and to give better incentives to banks, many countries are considering the introduction of risk-based insurance premiums. We have argued that when banks have private information concerning the quality of the bank's assets, it may be difficult to achieve such an incentive-compatible outcome.

The success of a deposit insurance will depend critically on the well-functioning of other components of the safety net of a country, such as lender-of-last-resort facilities, regulatory norms, supervisory policies and practices, intervention rules, and insolvency-resolution policies and mechanisms. The well-functioning of these components is interdependent. Therefore, each of these components should not be designed separately, but should be looked upon in conjunction.

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Annex Design features of existing deposit insurance schemes

This table presents several design features for all existing Explicit deposit insurance schemes as of end-year 2000. Panel A presents information regarding membership, administration and funding of deposit insurance by country. Panel B presents information regarding the coverage of the scheme. Panel C presents information regarding the pricing of deposit insurance. Since 2000, the introduction of deposit insurance has been planned or is under consideration in the following countries: Albania, Bolivia, China, Costa Rica, Hong Kong, Kuwait, Russia, and Zambia. Data on the features of the deposit insurance scheme of individual countries come from Garcia (2000) and Demirgüç-Kunt and Sobaci (2001). Data on the share of deposits covered in Brazil is from Beck (2001). n.a. indicates 'not available'.

Panel A Membership, Administration and Funding

Country	Date Enacted/Revised	Membership	Administration	Permanent Fund	Source of Funding	Fund Target	Actual Fund
		Compulsory=1	Official=1	Funded=1	Private=0	% of insured deposits	% of insured deposits
		Voluntary=0	Joint=2	Unfunded=0	Joint=1		
			Private=3		Public=2		
Argentina	1979/1995	1	3	1	1	12.50%	0.25%
Austria	1979/1996	1	3	0	1	n.a.	n.a.
Bahamas	1999	1	1	1	1	no	n.a.
Bahrain	1993	1	2	0	0	n.a.	n.a.
Bangladesh	1984/2000	1	1	1	1	n.a.	0.4%
Belgium	1974/1995	1	2	1	1	0.50%	0.25%
Brazil	1974/1981/1995	1	3	1	0	5.00%	n.a.
Bulgaria	1998	1	2	1	1	14.29%	n.a.
Cameroon	1999	0	2	1	1	n.a.	n.a.
Canada	1967/1995	1	1	1	1	no	0.19%
Central Afr. Rep.	1999	0	2	1	1	n.a.	n.a.
Chad	1999	0	2	1	1	n.a.	n.a.
Chile	1986	1	1	0	2	no	n.a.
Colombia	1985	1	1	1	0	n.a.	11.70%
Congo, Rep. of	1999	0	2	1	1	n.a.	n.a.
Croatia	1997/1999	1	2	1	1	5.00%	0.85%
Czech Rep.	1994	1	1	1	1	n.a.	n.a.
Denmark	1988/1998	1	3	1	1	n.a.	n.a.
Dominican Rep.	1962/1999	0	2	1	1	n.a.	n.a.

Country	Date Enacted/Revised	Membership Compulsory=1 Voluntary=0	Administration Official=1 Joint=2 Private=3	Permanent Fund Funded=1 Unfunded=0	Source of Funding Private=0 Joint=1 Public=2	Fund Target % of insured deposits	Actual Fund % of insured deposits
Ecuador	1998	1	1	1	1	50.00%	n.a.
El Salvador	1991/2000	1	1	1	1	n.a.	n.a.
Eq. Guinea	1999	0	2	1	1	n.a.	n.a.
Estonia	1998	1	2	1	1	3.00%	n.a.
Finland	1969/1992/1998	1	3	1	1	2.00%	0.14%
France	1980/1995/1999	1	3	1	0	n.a.	n.a.
Gabon	1999	0	2	1	1	n.a.	n.a.
Germany	1966/1976/1998	1	3	1	0	3% of loans	3% of loans
Gibraltar	1998	1	2	0	0	no	n.a.
Greece	1993/1995	1	2	1	1	no	n.a.
Guatemala	1999	1	1	1	1	10.00%	n.a.
Honduras	1999/2000	1	1	1	1	5.00%	n.a.
Hungary	1993	1	2	1	1	1.50%	1.00%
Iceland	1985/1996/2000	1	1	1	0	n.a.	n.a.
India	1961	1	1	1	1	2.0%	0.7%
Indonesia	1998	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Ireland	1989/1995	1	1	1	0	n.a.	n.a.
Italy	1987/1996/1999	1	3	0	1	0.4%-0.8%	0.65%
Jamaica	1998	1	1	1	1	1.00%	n.a.
Japan	1971	1	1	1	1	no	deficit
Kazakhstan	1999	n.a.	2	1	n.a.	n.a.	n.a.
Kenya	1985	1	1	1	1	20.0%	5.3%
Korea	1996	1	1	1	1	n.a.	n.a.
Latvia	1998	1	1	1	1	no	n.a.
Lebanon	1967/1991	1	2	1	1	n.a.	n.a.
Lithuania	1996	1	1	1	1	n.a.	5.68%
Luxembourg	1989/1999	1	3	0	0	n.a.	n.a.

Country	Date Enacted/Revised	Membership Compulsory=1 Voluntary=0	Administration Official=1 Joint=2 Private=3	Permanent Fund Funded=1 Unfunded=0	Source of Funding Private=0 Joint=1 Public=2	Fund Target % of insured deposits	Actual Fund % of insured deposits
Macedonia	1996/1997/1998/2000	1	3	1	1	5.00%	3.00%
Mexico	1986/1990/1999	1	1	1	1	no	0.11%
Morocco	1993/1996	1	1	1	0	no	n.a.
Netherlands	1979/1995	1	1	0	1	n.a.	n.a.
Nigeria	1988/1989	1	1	1	1	no	n.a.
Norway	1961/1997	1	3	1	1	n.a.	n.a.
Oman	1995	1	1	1	1	n.a.	n.a.
Peru	1992/1999	1	2	1	1	n.a.	n.a.
Philippines	1963	1	1	1	1	n.a.	n.a.
Poland	1995	1	2	1	1	n.a.	1.80%
Portugal	1992/1995	1	1	1	1	n.a.	n.a.
Romania	1996	1	2	1	1	n.a.	1.80%
Slovak Rep.	1996	1	2	1	1	1.50%	0.47%
Spain	1977/1996	1	2	1	1	1.67%	n.a.
Sri Lanka	1987	0	1	1	1	n.a.	n.a.
Sweden	1996	1	1	1	1	n.a.	n.a.
Switzerland	1984/1993	0	3	0	0	n.a.	n.a.
Taiwan	1985/1995/1999	1	1	1	1	5.0%	0.3%
Tanzania	1994	1	3	1	1	25.0%	22.5%
Thailand	1997	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Trinidad & Tob.	1986	1	1	1	1	no	n.a.
Turkey	1983	1	1	1	1	no	5.00%
Uganda	1994	1	1	1	1	no	n.a.
Ukraine	1998	1	1	1	1	n.a.	10.00%
United Kingdom	1982/1995	1	1	0	0	n.a.	n.a.
United States	1934/1991	1	1	1	1	1.25%	1.40%
Venezuela	1985	1	1	1	1	n.a.	n.a.

Panel B Coverage

Country	Foreign Currencies yes=1; no=0	Inter-Bank Deposits yes=1; no=0	Coverage Limits US$	Coverage to per capita GDP %	Co-insurance yes=1; no=0	% of the number of deposit accounts covered	% of the value of deposits covered
Argentina	1	0	$30,000	3.9	0	95	40
Austria	1	0	$21,600	0.9	1	n.a.	n.a.
Bahamas	1	1	$50,000	3.1	0	95	11.5
Bahrain	1	0	$5,640	0.7	1	n.a.	n.a.
Bangladesh	0	0	$2,020	5.5	0	96	31
Belgium	1	0	$21,600	1.0	0	n.a.	n.a.
Brazil	1	0	$17,070	4.9	0	98	43
Bulgaria	1	0	$2,297	1.6	1	n.a.	<35
Cameroon	0	1	$5,336	9.3	0	n.a.	n.a.
Canada	0	1	$40,790	1.8	0	87.5	35.9
Central Afr. Rep.	0	1	$3,557	13.3	0	n.a.	n.a.
Chad	0	1	$3,557	19.4	0	n.a.	n.a.
Chile	1	0	unlimited[1]	n.a.	1	94	9
Colombia	0	1	$7,500	3.8	1	98	34
Congo, Rep. of	0	1	$3,557	3.9	0	n.a.	n.a.
Croatia	1	0	$13,700	3.2	0	95	68
Czech Rep.	0	0	$11,620	2.4	1	n.a.	n.a.
Denmark	1	0	$43,470	1.4	0	n.a.	<50
Dominican Rep.	1	0	$12,280	5.3	1	n.a.	n.a.
Ecuador	1	1	$3,250	3.0	0	n.a.	n.a.
El Salvador	1	0	$6,280	3.0	0	n.a.	n.a.
Eq. Guinea	0	1	$3,557	2.8	0	n.a.	n.a.
Estonia	1	0	$1,210	0.3	1	n.a.	1
Finland	1	0	$27,270	1.2	0	96	40
France	1	0	$66,670	3.1	0	87.5	n.a.
Gabon	0	1	$5,336	1.3	0	n.a.	n.a.

Country	Foreign Currencies yes=1; no=0	Inter-Bank Deposits yes=1; no=0	Coverage Limits US$	Coverage to per capita GDP %	Co-insurance yes=1; no=0	% of the number of deposit accounts covered	% of the value of deposits covered
Germany	1	0	$21,600	0.9	1	n.a.	n.a.
Gibraltar	1	n.a.	$21,600	n.a.	1	n.a.	n.a.
Greece	1	0	$21,600	2.0	0	n.a.	n.a.
Guatemala	0	1	$2,800	1.7	0	92.5	n.a.
Honduras	1	0	$7,000	7.7	0	n.a.	n.a.
Hungary	1	0	$4,498	1.0	0	97	48
Iceland	1	0	$21,600	0.7	0	n.a.	n.a.
India	1	0	$2,300	4.9	0	98	72
Indonesia	1	1	unlimited	unlimited	0	100	100
Ireland	1	0	$21,600	0.9	1	n.a.	n.a.
Italy	1	0	$111,240	6.0	1	n.a.	62
Jamaica	1	0	$5,000	1.9	0	90	33.5
Japan	0	0	unlimited	unlimited	0	100	100
Kazakhstan	1	0	n.a.	n.a.	1	n.a.	n.a.
Kenya	1	1	$1,390	4.0	0	83.3	16
Korea	0	0	unlimited	unlimited	0	100	100
Latvia	1	0	$870	0.3	0	94.7	18.7
Lebanon	0	1	$3,320	0.9	0	n.a.	n.a.
Lithuania	1	0	$11,250	3.7	1	98.8	44
Luxembourg	1	0	$21,600	0.5	1	n.a.	n.a.
Macedonia	1	0	$5,550	3.4	1	100	99
Mexico	1	0	unlimited	unlimited	0	100	100
Morocco	1	1	$5,090	4.4	0	n.a.	n.a.
Netherlands	1	0	$21,600	0.9	0	n.a.	n.a.
Nigeria	0	1	$140	0.4	0	78	21
Norway	1	0	$253,520	7.6	0	99.8	76.1
Oman	1	0	$52,080	8.8	1	n.a.	n.a.
Peru	1	0	$17,770	8.5	0	n.a.	n.a.
Philippines	1	1	$2,490	2.5	0	n.a.	n.a.

Country	Foreign Currencies yes=1; no=0	Inter-Bank Deposits yes=1; no=0	Coverage Limits US$	Coverage to per capita GDP %	Co-insurance yes=1; no=0	% of the number of deposit accounts covered	% of the value of deposits covered
Poland	0	0	$11,880	2.9	1	n.a.	n.a.
Portugal	1	0	$21,600	2.1	1	n.a.	n.a.
Romania	1	0	$1,920	1.2	0	96	n.a.
Slovak Rep.	1	0	$6,790	1.9	0	n.a.	47
Spain	1	0	$21,600	1.5	0	94	60
Sri Lanka	0	0	$1,330	1.6	0	n.a.	n.a.
Sweden	1	0	$30,956	1.2	0	n.a.	n.a.
Switzerland	0	0	$19,600	0.6	0	n.a.	n.a.
Taiwan	0	0	$31,500	2.3	0	94	45
Tanzania	0	0	$310	1.1	0	54	12
Thailand	1	1	unlimited	unlimited	0	100	100
Trinidad & Tob.	0	0	$8,000	1.5	0	96.3	34.1
Turkey	1	0	unlimited	unlimited	0	100	100
Uganda	0	0	$1,890	6.7	0	95	26
Ukraine	0	0	$120	0.2	0	n.a.	19
United Kingdom	1	0	$33,333	1.4	1	70	n.a.
United States	1	1	$100,000	2.8	0	99	65.2
Venezuela	0	0	$6,330	1.3	0	n.a.	n.a.

[1] Chile has unlimited coverage for demand deposits only. For savings deposits, the coverage limit is US$ 3,400.

Panel C Pricing

Country	Assessment Base	Annual Premiums % of assessment base	Risk-Adjusted yes=1; no=0	Basis for Adjusting Premiums
Argentina	insured deposits	0.3 plus 0.36-0.72	1	CAMEL-like ratios and risk assets
Austria	insured deposits	pro rata, ex post	0	Not applicable
Bahamas	insured deposits	0.05	0	Not applicable
Bahrain	deposits	ex post	0	Not applicable
Bangladesh	deposits	0.005	0	Not applicable
Belgium	insured deposits	0.02 plus 0.04 if necessary	0	Not applicable
Brazil	deposits	0.3 plus 0.15 extraordinary contribution	0	Not applicable
Bulgaria	insured deposits	0.5	0	Not applicable
Cameroon	deposits plus NPLs	0.15% of deposits + 0.5% of NPLs	1	Non-performing loans
Canada	insured deposits	0.04 to 0.33	1	CAMEL-like ratios, asset concentration, regulatory rating and adherence to standards
Central Afr. Rep.	deposits plus NPLs	0.15% of deposits + 0.5% of NPLs	1	Non-performing loans
Chad	deposits plus NPLs	0.15% of deposits + 0.5% of NPLs	1	Non-performing loans
Chile	not applicable	not applicable	0	Not applicable
Colombia	insured deposits	risk-adjusted	1	Independent rating (is pending)
Congo, Rep. of	deposits plus NPLs	0.15% of deposits + 0.5% of NPLs	1	Non-performing loans
Croatia	insured deposits	0.8	0	Determined by Central Bank
Czech Rep.	insured deposits	0.5 (savings banks 0.1)	0	Not applicable
Denmark	insured deposits	0.2 (maximum)	0	Not applicable
Dominican Rep.	deposits	0.1875	0	Not applicable
Ecuador	deposits	0.65 + risk-adjustment	1	Risk rating
El Salvador	deposits	0.1 (can be raised to 0.3) + risk-based mark-up	1	sub-standard securities
Eq. Guinea	deposits plus NPLs	0.15% of deposits + 0.5% of NPLs	1	Non-performing loans
Estonia	deposits	0.5 (maximum)	0	Not applicable
Finland	insured deposits	0.05 to 0.3	1	Solvency ratio
France	deposits plus 1/3 loans	risk-adjusted	1	CAMEL-like ratios

Country	Assessment Base	Annual Premiums % of assessment base	Risk-Adjusted yes=1; no=0	Basis for Adjusting Premiums
Gabon	deposits plus NPLs	0.15% of deposits + 0.5% of NPLs	1	Non-performing loans
Germany	insured deposits	0.008 (statutory scheme); 0-0.1 (private sector)	1	Risk category and length of membership
Gibraltar	insured deposits	Administrative expenses and ex post	0	Not applicable
Greece	deposits	decreasing by size: 0.0025 to 0.125	0	Not applicable
Guatemala	insured deposits	1.0 + 0.5 when the fund falls below its target	0	Not applicable
Honduras	deposits	Not more than 0.25	0	Not applicable
Hungary	insured deposits	0.16-0.19 (decreasing by size) + risk-adjustment	1	Capital adequacy
Iceland	insured deposits	0.15	0	Not applicable
India	deposits	0.05	0	Not applicable
Indonesia	not applicable	not applicable	not applicable	Not applicable
Ireland	insured deposits	0.2	0	Not applicable
Italy	insured funds	ex post, adjusted for size and risk	1	CAMEL and maturity transformation
Jamaica	insured deposits	0.1	0	Not applicable
Japan	insured deposits	0.048 + 0.036	0	Not applicable
Kazakhstan	insured deposits	0.125-0.375	1	CAMEL-like ratios
Kenya	deposits	0.15	0	Not applicable
Korea	deposits	0.05	0	Not applicable
Latvia	insured deposits	0.3	0	Not applicable
Lebanon	credit accounts	0.05	0	Not applicable
Lithuania	insured deposits	1.0	0	Not applicable
Luxembourg	insured deposits	ex post to a maximum of 5% of capital	0	Not applicable
Macedonia	insured deposits	0.01-0.025	1	CAMEL-like ratios
Mexico	deposits and other liabilities	0.4-0.8	1	Determined by ministry of finance
Morocco	Deposits	0.2	0	Not applicable
Netherlands	insured deposits	ex post to a maximum of 10% of capital	0	Not applicable
Nigeria	Deposits	0.9375	0	Not applicable
Norway	risk-weighted assets and deposits	0.5 of risk-weighted assets and 0.15 of deposits	1	Risk-weighted assets
Oman	Deposits	0.02, not to exceed 0.3	0	Not applicable

Country	Assessment Base	Annual Premiums % of assessment base	Risk-Adjusted yes=1; no=0	Basis for Adjusting Premiums
Peru	insured deposits	0.65 plus risk-adjustment	1	Determined by supervisor
Philippines	Deposits	0.2	0	Not applicable
Poland	risk-weighted assets and deposits	up to 0.4	1	Risk-weighted assets
Portugal	insured deposits	0.08 to 0.12	1	CAMEL-like ratios
Romania	insured deposits	0.3 to 0.6	1	CAMEL-like ratios
Slovak Rep.	insured deposits	0.1 to 0.3	0	Not applicable
Spain	insured deposits	0.1 (maximum of 0.2)	0	Not applicable
Sri Lanka	Deposits	0.15	0	Not applicable
Sweden	insured deposits	0.5 (maximum)	1	Capital adequacy
Switzerland	gross earnings and balance sheet items	ex post, on demand, varies	1	Earnings and some discretion
Taiwan	insured deposits	0.05-0.06	1	CAR and early warning system
Tanzania	deposits	0.1	0	Not applicable
Thailand	not applicable	not applicable	Not applicable	Not applicable
Trinidad & Tob.	deposits	0.2	0	Not applicable
Turkey	insured savings deposits	1.0-1.2	1	Capital adequacy
Uganda	Deposits	0.2	0	Not applicable
Ukraine	total deposits	0.5 plus special charges	0	Not applicable
United Kingdom	insured deposits	on demand, not to exceed 0.3	0	Not applicable
United States	domestic deposits	0.00-0.27	1	CAMEL-like ratios
Venezuela	insured deposits	2.0	0	Not applicable

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